Syllabus

Course Information

Course Number:	CSCE 631
Course Title:	Intelligent Agents: Computational Game Solving
Section:	600
Time:	Tuesday,Thursday 09:35AM – 10:50AM.
Location:	HRBB 126
Credit Hours:	*3*

Instructor Details

Instructor:	Alan Kuhnle
Office:	421 Peterson Building (PETR)
Zoom:	https://tamu.zoom.us/my/kuhnle
E-Mail:	kuhnle@tamu.edu
Office Hours:	MW 10:00 – 11:00AM, in PETR 421 *or by appointment*

Course Description

Delve into the world of intelligent agents and explore the design and implementation of coordination mechanisms among multiple agents. This advanced course bridges theoretical principles and practical methods for implementing intelligent agents in complex, strategic environments. In most real-world strategic settings, games are characterized by multi-step imperfect information, presenting unique challenges such as signaling, deception, and interpreting the deceptive actions of others. Since 2003, significant advancements in the AI community have revolutionized the way these games are approached and solved. This course aims to provide a comprehensive understanding of both the foundational theories and the cutting-edge techniques in this field.

Course Prerequisites

CSCE 420 or CSCE 625

Special Course Designation

None.

Course Learning Outcomes

Upon completion of this course, students should be able to:

- Understand fundamental concepts and techniques used in Multi-Agent Systems, including the elements of game theory

- 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.
- Communicate effectively about Multi-Agent Systems concepts and ideas to other students and professionals.

Textbook and/or Resource Materials

Resources:
The course will be lecture based. At the end of the course there will be a few lectures of project presentations by students. Readings will consist of a mixture of papers and course notes.

- Textbook: Shoham and Leyton-Brown. *Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations (MAS)*

Course Webpage: https://www.alankuhnle.com/teaching/f25-631/index.html

Grading Policy

Exams (50%).
Two exams (one midterm and one final) will assess understanding of theoretical foundations, algorithms, and analysis techniques. Exams will primarily use automatically graded questions, with a small number of short written responses.

Programming Assignments (25%).
Five hands-on programming assignments will guide students through implementing core algorithms and concepts in game solving. Assignments will be completed in Python (via Google Colab) and submitted electronically. Autograding will be used to ensure consistency and rapid feedback.

Course Project (25%).
Students will complete an individual or two-person project applying course methods to a small research or implementation problem. Deliverables include a short proposal, code/notebook, a written report (approximately 4 pages), and a brief presentation at the end of the semester.

Grading Distribution.

Component	Weight
Midterm Exam	25%
Final Exam	25%
Programming Assignments (5 total)	25%
Course Project	25%
Total	**100%**

The grading scale will be: A ≥ 90% > B ≥ 80% > C ≥ 70% > D ≥ 60% > F.

Programming Assignments.

There will be five programming assignments (PAs), each worth 5% of the course grade. Assignments are designed to reinforce major topics by guiding you through hands-on implementations in Python (via Google Colab).

- **Format:** Each PA is distributed as a Colab notebook containing instructions, starter code, and public test cases. You will complete the required code blocks and submit the `.ipynb` file through Canvas.
- **Grading:** Most functionality will be graded automatically using public and hidden tests. A short written "methods note" (150–250 words) will also be required in each assignment.
- **Late Policy:** You have 3 slip days total for programming assignments, usable in 24-hour increments (maximum of 2 per assignment). After slip days are used, late submissions are penalized 10% per day, up to 3 days.
- **Topics:**
    - **PA1 – Normal-Form Games:** Payoffs, best responses, and simple equilibrium checks.
    - **PA2 – Regret Minimization:** Implement regret matching and RM+, applied to Rock–Paper–Scissors.
    - **PA3 – Counterfactual Regret Minimization:** Apply CFR to Kuhn poker and track exploitability.
    - **PA4 – Abstraction:** Implement and evaluate a simple action abstraction in a toy game.
    - **PA5 – Opponent Exploitation:** Compute best responses and safe best responses from opponent data.

Late Work Policy

Assignments are due at date and time indicated on the assignment. 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.

For the Programming Assignments: You have 3 slip days total for programming assignments, usable in 24-hour increments (maximum of 2 per assignment). After slip days are used, late submissions are penalized 10% per day, up to 3 days.

Course Schedule

Weeks	Topic Area	Key Concepts & Activities
1–2	**Foundations of Strategic Games**	Normal-form games, Nash equilibria, basic solution concepts; introduction to Python/Colab workflow.
3–4	**Algorithms for Equilibria**	Lemke–Howson, linear programming approaches, correlated equilibria.
5–6	**Regret Minimization**	Regret matching, RM+, connection to equilibrium; first programming assignments.
7	**Midterm Exam**	Covers foundations, equilibria, and regret minimization.
8–9	**Extensive-Form Games**	Sequence form, counterfactual regret minimization (CFR); Kuhn poker case study.
10–11	**Abstraction and Approximation**	Information/state abstraction, evaluation of abstractions.
12	**Opponent Modeling and Exploitation**	Safe best response, robustness vs. exploitation.
13	**Applications and Case Studies**	Examples from large-scale imperfect-information games (e.g., poker, AlphaStar).
14	**Course Project Presentations**	Student project presentations and discussion.
15	**Final Exam**	Comprehensive, emphasizing integration of methods.

Major Assignments and Due Dates

- **Programming Assignment 1 (Normal-Form Games)** – Due Week 2
- **Programming Assignment 2 (Regret Minimization)** – Due Week 4
- **Programming Assignment 3 (CFR on Kuhn Poker)** – Due Week 7
- **Midterm Exam** – Week 7
- **Programming Assignment 4 (Abstraction)** – Due Week 10
- **Programming Assignment 5 (Opponent Exploitation)** – Due Week 12
- **Project Proposal** – Due Week 6
- **Project Progress Report** – Due Week 11
- **Project Presentation & Report** – Week 14
- ***Final Exam*** – *As scheduled by registrar.*

University Policies

This section outlines the university-level policies that must be included in each course syllabus. The TAMU Faculty Senate established the wording of these policies.

***NOTE**: Faculty members should not change the written statements. A faculty member may add separate paragraphs if additional information is needed.*

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.

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.

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.

Notice of Nondiscrimination

Texas A&M University is committed to providing safe and non-discriminatory learning, living, and work environments for all members of the University community. The University provides equal opportunity to all employees, students, applicants for employment or admission, and the public regardless of race, color, sex (including pregnancy and related conditions), religion, national origin, age, disability, genetic information, or veteran status. Texas A&M University will promptly, thoroughly, and fairly investigate and resolve all complaints of discrimination, harassment (including sexual harassment), complicity and related retaliation based on a protected class in accordance with System Regulation 08.01.01, University Rule 08.01.01.M1, Standard Administrative Procedure (SAP) 08.01.01.M1.01, and applicable federal and state laws. In accordance with Title IX and its implementing regulations, Texas A&M does not discriminate on the basis of sex in any educational program or activity, including admissions and employment. The following person has been designated to handle inquiries and complaints regarding the non-discrimination policies: Jennifer M. Smith, TAMU Associate VP & Title IX Coordinator at YMCA Ste 108, College Station, TX 77843, 979-458-8407, or email civilrights@tamu.edu. For other reporting options, visit https://ocrcas.ed.gov/contact-ocr to locate the address and phone number of the office that serves your area, or call 1-800-421-3481.

Civil Rights, Free Speech, and Title IX Policies

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 discrimination and harassment based on an individual's race, color, sex, (including pregnancy and related conditions), religion, national origin, age, disability, genetic information, veteran status, or any other legally protected characteristic. This includes forms of sex-based violence, such as sexual assault, sexual harassment, sexual exploitation, dating/domestic violence, and stalking.

Students can report discrimination/harassment, access supportive resources, or learn more about their options for resolving complaints on the University's Civil Rights & Title IX webpage.

Students should be aware that all university employees (except medical or mental health providers) are mandatory reporters, which means that if they observe, experience or become aware of an incident that they reasonably believe to be discrimination/harassment alleged to have been committed by or against a person who was a student or employee at the time of the incident, the employee must report the incident to the university.

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.

To request academic accommodations, contact the designated ADA office based on your location:

- Texas A&M University, College of Nursing, College of Dentistry, Irma Lerma Rangel College of Pharmacy College Station, College of Medicine, School of Public Health, Institute of Biosciences and Technology, EnMed Program, Bush School in Washington DC, Mays Business School – CityCentre, TAMU Engineering Academies, Texas A&M University Higher Education Center at McAllen and Texas A&M University at Galveston should contact Disability Resources at (979) 845-1637 or disability@tamu.edu.
- Texas A&M University School of Law should contact the Office of Student Affairs at (817) 212-4111 or law-disability@law.tamu.edu to request accommodations.
- Irma Lerma Rangel College of Pharmacy in Kingsville should contact the Disability Resource Center at Texas A&M University - Kingsville at (361) 593-3024 or drc.center@tamuk.edu to request accommodations.
- Texas A&M University College of Veterinary Medicine & Biomedical Sciences in Canyon should contact the Office of Student Accessibility at West Texas A&M University – Canyon at (806) 651-2335 or osa@wtamu.edu.
- Texas A&M University at Qatar (TAMUQ) should contact the campus psychologist, Dr. Steve Wilson +974-4423-0047 or stephen.wilson@qatar.tamu.edu.

If you are experiencing difficulties with your approved accommodations, contact the office responsible for approving your accommodations or the Texas A&M ADA Coordinator Julie Kuder at ADA.Coordinator@tamu.edu or (979) 458-8407.

Pregnancy Accommodations

Texas A&M provides reasonable accommodations to students due to pregnancy and/or related conditions, such as childbirth, recovery and lactation. Students should contact the University's Pregnancy Coordinator as soon as they become aware of the need for accommodation. Depending on the circumstances, accommodations could include extended time to complete assignments or exams, changes in course sequence, or modifications to the physical classroom environment. Texas A&M will also allow a voluntary leave of absence, ensure the availability of lactation space, and maintain grievance procedures to provide for the prompt and equitable resolution of complaints of sex discrimination. For information regarding pregnancy accommodations, email TIX.Pregnancy@tamu.edu.

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 on its mental health webpage. 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.org.

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.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 988 Suicide & Crisis Lifeline (988) or at 988lifeline.org.

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.

Statement on the Family Educational Rights and Privacy Act (FERPA)

FERPA is a federal law designed to protect the privacy of educational records by limiting access to these records, to establish the right of students to inspect and review their educational records and to provide guidelines for the correction of inaccurate and misleading data through informal and formal hearings. Currently enrolled students wishing to withhold any or all directory information items can do so within howdy.tamu.edu using the Directory Information Withholding Form. The complete FERPA Notice to Students and the student records policy is available on the Office of the Registrar webpage.
Items that can never be identified as public information are a student's social security number, citizenship, gender, grades, GPR or class schedule. All efforts will be made in this class to protect your privacy and to ensure confidential treatment of information associated with or generated by your participation in the class.

Directory items include name, UIN, local address, permanent address, email address, local telephone number, permanent telephone number, dates of attendance, program of study (college, major, campus), classification, previous institutions attended, degrees honors and awards received, participation in officially recognized activities and sports, medical residence location and medical residence specialization.

Campus-Specific Policies

Campuses may establish their own policies and minimum syllabus requirements. As long as these policies and requirements do not contradict the university level requirements, Campuses can add them in this section. Please remove this section if not needed.

College and Department Policies

College and departmental units may establish their own policies and minimum syllabus requirements. As long as these policies and requirements do not contradict the university level requirements, colleges and departments can add them in this section. Please remove this section if not needed.

Optional Syllabus Statements

Free Speech and Civil Discourse

Texas A&M recognizes that the pursuit of truth through open and robust discourse is critical to academic inquiry. However, as a community of scholars, the university has an aspirational expectation that such discourse will be conducted in accordance with Aggie Core Values. In this "marketplace of ideas," we encourage civil dialogue creating an environment that allows individuals to express their ideas and to have their ideas challenged in respectful and responsible ways. Students can learn more about Freedom of Expression and Free Speech on the University's website about the First Amendment.

Artificial Intelligence Statement

According to the Texas A&M University Definitions of Academic Misconduct, plagiarism is the appropriation of another person's ideas, processes, results or words without giving appropriate credit (aggiehonor.tamu.edu). You should credit your use of anyone else's words, graphic images, or ideas using standard citation styles. Artificial Intelligence (AI) text generators and natural language processing tools (colloquially, chatbots - such as ChatGPT), audio, computer code, video, and image generators should not be used for any work for this class without explicit permission of the instructor and appropriate attribution. This includes, but is not limited to,

i. Creating or revising drafts
ii. Editing your work
iii. Reviewing a peer's work

This excludes pre-existing software additions such as spelling and grammar checkers, which are acceptable.