

CSCE 631 — Algorithmic Game Theory meets LLMs

Welcome to the Course

Dr. Alan Kuhnle — Texas A&M University

Summer I 2026

Course at a Glance

- **5 weeks:** May 26 – June 29 (Summer I)
- **Fully asynchronous** — online, no scheduled meetings
- **No exams, no quizzes**
- Two programming assignments + one course project
- All materials at:
<https://www.alankuhnle.com/teaching/su26-631/>

The Big Idea

Classical game theory provides the **mathematical foundations**;
modern LLMs are the new **strategic agents**.

This course connects both.

What You'll Learn — The Five Modules

Week	Module	Key Topics
1	Foundations of Game Theory	Normal-form games, Nash equilibrium, dominated strategies, correlated equilibrium
2	Computing Equilibria	LP methods, support enumeration, regret matching, no-regret learning
3	Extensive-Form Games & CFR	Sequential games, information sets, counterfactual regret minimization
4	Game Abstraction & Poker	Libratus, Pluribus, card abstraction, safe subgame solving
5	LLMs as Strategic Agents	Multi-agent debate, red-teaming, CoALA, tree-search reasoning

How the Course Works

Each week:

- Watch pre-recorded lecture videos (3–4 hours per week)
- Slides **and** detailed LaTeX notes for every module
- Work on assignments at your own pace

Assessments:

- **PA1 & PA2:** Jupyter notebooks with Python implementation
- **Course Project:** individual research or implementation — your choice from 10 curated topics
- No midterm. No final.

All materials available at alankuhnle.com/teaching/su26-631/

Grading Breakdown

Component	Weight	Due Date
PA1 — Normal-Form Games	20%	June 6
PA2 — Multi-Agent Debate	30%	June 27
Course Project — Proposal	50%	June 6
Course Project — Final		June 29

No midterm. No final exam.

Your grade reflects what you build.

Course Project — Overview

- **Individual** project, worth 50% of your grade
- Choose from **10 curated topics** spanning classical game theory, LLM agents, and the bridge between them
- **Proposal** (1 page, 5%) — due June 6
- **Final deliverable** (code + 4-page report, 45%) — due June 29
- Multiple students can pick the same topic — you work independently
- Custom topics welcome with instructor approval

Full topic list with details, rubric, and tips:
[course-project.pdf](#) on the course website

Course Project — Selected Topics

Topic	What You'd Do
Convergence of Regret-Matching Variants	Implement and compare RM, RM+, predictive RM
CFR Beyond Kuhn Poker	Build a CFR solver for Leduc Hold'em
LLM Debate Protocol Design	Vary debate structure and analyze outcomes
Red-Teaming with Game-Theoretic Search	Formalize attacker-defender as a two-player game
Do LLMs Play Nash?	Evaluate LLM strategic behavior against known equilibria
Tree-Search Reasoning for LLM Agents	Implement MCTS/beam-search wrapper around an LLM

6 of 10 topics shown — see [course-project.pdf](#) for the full list with starting points and deliverables.

TAMU API — What It Is and Why It Matters

- Texas A&M provides access to **Claude, GPT, and Gemini** through `chat.tamu.ai`
- **OpenAI-compatible** — use the standard `openai` Python library
- **\$5/day** budget per student
- Required for **PA2** and several project topics

Available Models

- Claude Sonnet 4.5
- Claude Opus 4.5
- GPT-5.2, o3
- Gemini 2.5 Pro & Flash
- ... and 25 more

TAMU API — Getting Set Up

Two credentials needed:

1. **Shared API key** — provided in the guide
Same key for the whole course; it identifies the “CSCE 631” application.
2. **Personal CF_Authorization cookie** — extracted from your browser
Log into `chat.tamu.ai` with TAMU SSO → DevTools → Application or Network tab.
Expires every ~24 hours — you’ll refresh it each session.

Important for Claude models: thinking mode is enabled server-side.

You must set `temperature=1` and `max_tokens` ≥ 16384 .

Haiku, GPT, and Gemini models work with standard parameters.

Step-by-step guide: [TAMU-API-Guide.pdf](#) on the course website

This Week — Get Started

1. **Watch Lectures 1–4** — Foundations of Game Theory
 - Normal-form games, Nash equilibrium, dominated strategies, correlated equilibrium
2. **Download PA1** notebook and start working
 - Due **June 6**
3. **Read the Course Project** topic list — start thinking about your top 3
 - Proposal also due **June 6**
4. **Set up the TAMU API** — follow the guide, make the test call

Questions? Post on the Canvas discussion board
or email kuhn1e@tamu.edu