Missouri University of Science and Technology	Department of Computer Science
Fall 2023	**CS 5408: Game Theory for Computing**

SYLLABUS

Instructor: *Sid Nadendla*   **Email:** *nadendla@mst.edu*

1 Course Information

Course Website:	https://sid-nadendla.github.io/teaching/FS2023_GTC/index.html
Lecture Venue:	Room 209, Computer Science Building
Lecture Time:	Tuesdays & Thursdays – 11:00 AM - 12:15 PM
Instructor's Office Location:	313 Comp Sci Building
Instructor's Office Hours:	Friday – 4:00 PM - 5:00 PM (Venue: TBD)
Instructor's Contact Details:	nadendla@mst.edu, (573) 341-4090
Grader's Name and Email:	TBD
Grader's Office Hours:	TBD

2 Intended Audience & Prerequisites

Students taking this class are expected to have a strong foundation in linear algebra ('C' or better grade in Math 3108), algorithms ('C' or better grade in Comp Sci 2500), along with basic background in probability theory and/or statistics ('C' or better grade in one of Stat 3113, Stat 3115, Stat 3117, or Stat 5643.).

3 Textbook

In this course, we will not be following any one textbook. However, students are encouraged to refer to one or more recommended books[1] from the following (non-exhaustive) list:

- Roger B. Myerson, "Game Theory: Analysis of Conflict," Harvard University Press, 1991.

- Bernhard von Stengel, "Game Theory Basics," Cambridge University Press, 2022.

- Drew Fudenberg, Jean Tirole, "Game Theory," MIT Press, 1991.

- Tamer Başar and Geert Jan Olsder, "Dynamic Noncooperative Game Theory," SIAM, 2nd Ed., 1999.

- Martin J. Osborne, "An Introduction to Game Theory," Oxford University Press, 2003.

- Noam Nisan *et al.* (Editors), "Algorithmic Game Theory, " Cambridge University Press, 2007.

- John von Neumann and Oskar Morgenstern, "Theory of Games and Economic Behavior," 60th Anniversary Commemorative Edition, Princeton University Press, 2007.

- Yoav Shoham, Kevin Leyton-Brown, "Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations," Cambridge University Press, 2008.

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[1]Links to free electronic copies of the books will be provided on the course website, if they are available.

- Herbert Gintis, "Game Theory Evolving: A Problem-Centered Introduction to Modeling Strategic Interaction," Princeton University Press, 2nd Ed., 2009.

- David Easley and Jon Kleinberg, "Networks, Crowds and Markets: Reasoning about a Highly Connected World," Cambridge University Press, 2010.

4   Description

Game theory is a powerful framework that models strategic interactions between competing entities in various domains such as economics, computer science, business, politics and transportation. This course introduces the mathematical and computational foundations of game theory, and its applications particularly in computer science (e.g., cybersecurity, robotics and networking). Topics include rationality, noncooperative game models (e.g., normal form, extensive form), solution concepts (e.g., Nash equilibrium, subgame perfect equilibrium), effects of information asymmetry (e.g., Bayesian games), dynamical settings (e.g., repeated games), strategic alliances (e.g., cooperative game theory), and mechanism design (e.g., auctions).

5   Course Objectives

- Develop analytical thinking to model individual/group rationality in diverse decision-making contexts.

- Gain mastery in modeling strategic interactions under different informational vignettes using games.

- Become proficient in applying/finding relevant solutions for different games.

- Develop the ability to model and solve games in dynamic settings using richer solution concepts.

- Cultivate the ability to reason how/why autonomous decision makers form strategic alliances (teams).

- Design strategic mechanisms to achieve desired objectives when the participating agents act rationally in their own respective manner.

6   Tentative Schedule & Prospective List of Topics

Topic	Subtopics	# Lectures
Decision Theory	Revealed Preferences, Utilities, Bounded Rationality, Domination	4
Basic Models	Representation, Nash Equilibrium, Bayesian Games	6
Coalitional Games	Transferable Utility, Core, Shapley Value	4
Exam 1	*Early-Mid October*	1
Dynamic Games	Subgame Perfect Equilibrium, Sequential Equilibrium, Repeated Games	6
Mechanism Design	Social Choice, Revelation Principle, Truthfulness, VCG Auctions	4
Adv. Sol. Concepts	Correlated Equilibrium, Evolutionary Games	2
Exam 2	*Last Week of Classes*	1

7 Grading Information

Students' grades will be calculated based on homework assignments, examinations, quizzes and a project, as shown below:

Assignments (Top-5 of HWs 1-6):	30% of total grade
Quizzes (Top-5 of Quizzes 1-6):	10% of total grade
Exams (1 and 2):	40% of total grade
Projects (1 and 2):	20% of total grade
Final Grade:	$[90-100]$: A, $[75-90)$: B, $[60-75)$: C, $[50-60)$: D, < 50: F

All the grades will be posted and maintained on Canvas.

8 Course Policies & Campus Resources

8.1 Logistics and Required Materials

Students will submit all of their homework assignments via **Gitlab**, regarding which the instructor will discuss in the first class. Quizzes will be conducted on Canvas at the time of the class, regarding which no exceptions will be made whatsoever. Students are strongly encouraged to meet either the instructor, or the grader, and ask questions regarding the assignments before their submission. Instructor will attempt to respond any email question within 24 hours upon their receipt. If the student did not receive any reply within 48 hours, they should send him a reminder under the same email chain.

One Canvas (https://umsystem.instructure.com/) will only be used to maintain grades, conduct quizzes and post recorded lectures (only when the instructor is out-of-town, attending conferences). All other information (including lecture notes, assignments and Jupyter notebooks) used in this course will be found only in the course website. If needed, laptops, web cams, scanners[2] (if submitting a hand-written assignment), headsets, microphones, or other resources are available for checkout from the Service Desk in the library.

8.2 COVID Update on Classroom Instruction

For the Fall 2023 semester, in-person courses and assessments are scheduled without distancing between students. To protect our campus community and each other from the risks of COVID-19 infection, we strongly encourage all students, faculty, and staff to be up-to-date on COVID-19 vaccinations. Staying home when you are sick and seeking testing when you have symptoms of COVID-19 will be our most effective measures to mitigate against the spread of the virus.

8.3 Contingency Informaation

Students are strongly advised to contact Student Health Services (mstshs@mst.edu, 573-341-4284) immediately, if they become ill or are unable to attend class or take tests on campus. If a student is isolating, the student should obtain an absence note from Student Health and not Student Support and Community Standards (Care Management), and forward it to the instructor. If the instructor is unavailable due to travel

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[2]There are several mobile applications available in different platforms that can use the camera in smart devices to scan documents.

or health reasons, the instructor will either post recorded lectures on CANVAS, or will switch to online instructor based on his availability.

8.4 S&Tconnect

S&T Connect ("Starfish" icon on Canvas toolbar) enables students to request appointments with their instructors and advisors via the S&T Connect calendar, which syncs with the Outlook Exchange calendar. S&T Connect tracks each student's performance across all courses. S&T Connect Early Alert enables students to be provided with services as needs arise.

8.5 Reporting Academic Dishonesty

Students are expected to submit all their assignments, exams and quizzes independently in a timely manner. Incidents involving behaviors such as cheating, plagiarism, or sabotage in an academic context will be reported to the instructor's department chair and the Vice Provost of Academic Support as violations of the Student Academic Regulations. Such reporting is carried out in addition to, and separate from, grade penalties for these violations. The process of reporting academic dishonesty is discussed in detail below: https://undergrad.mst.edu/academicintegrity/facultyresources-ai/

8.6 Artificial Intelligence

Unauthorized use of artificially generated content violates University Student Academic Standards without consent of the instructor. Students are not allowed to use ChatGPT and other AI systems in writing their responses to questions posted in homework assignments. Instead, the instructor encourages students to use Generative AI tools to learn the fundamentals of game theory, and discuss with the instructor to verify the correctness of the material. For more resources, visit https://teaching.missouri.edu/blog/teaching-time-ai

8.7 Reporting Non-Academic Misconduct

Students must uphold all non-academic misconduct standards, in addition to the academic standards, as outlined in the University of Missouri Collected Rules and Regulations Section 200.010[3]. Instances of non-academic misconduct, which may include but are not limited to disruption, obstruction, failure to comply, and/or forgery shall be reported to Student Support and Community Standards[4].

8.8 Student Support and Community Standards

Student support and community standards has a dedicated team and numerous resources such as UCARE and the student emergency fund to help students navigate the S&T experience and support their success. This includes support to address barriers related to academic, personal, emotional, medical, financial, or any other needs.

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[3]Ref. https://www.umsystem.edu/ums/rules/collected_rules/programs/ch200/200.010_standard_of_conduct
[4]Ref. https://studentsupport.mst.edu/communitystandards/

8.9   UCARE

UCARE is the central point of contact to connect a student who may be experiencing a personal, academic, financial, wellbeing, and/or other concern to support and resources. Sharing your concern with UCARE helps connect a student with solution-focused assistance to support their holistic well-being, success, and academic progress. A referral can be submitted at https://go.mst.edu/ucare-refer or by emailing ucare@mst.edu. For urgent matters, check out the after-hour and urgent resources.

8.10   Statement about Copyright, FERPA, and Use of Video

It is vitally important that our classroom environment promote the respectful exchange of ideas. This entails being sensitive to the views and beliefs expressed during discussions, whether in class or online. Please obtain instructor permission before recording any class activity. It is a violation of University of Missouri policy to distribute such recordings without authorization and the permission of all who are recorded. More information is provided in the following link:
https://www.umsystem.edu/ums/elearning/policies.

8.11   Accessibility and Accommodations

It is the university's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on a disability, please contact Student Accessibility and Testing at (573) 341-6655, email dss@mst.edu, or visit https://saat.mst.edu/ for information.

8.12   Student Honor Code and Academic Integrity

For a detailed explanation on academic dishonesty and student honor code, students may refer to the following resources.

- All students are expected to follow the Honor Code, which can be found at this link:
  https://stuco.mst.edu/documents/honor-code/

- Student Academic Regulations describes the student standard of conduct relative to the University of Missouri System's Collected Rules and Regulations section 200.010[5], and offers descriptions of academic dishonesty including cheating, plagiarism, sabotage, and unauthorized use of artificially generated content, any of which will be reported to the Vice Provost for Undergraduate Education.

- Other resources for students regarding academic integrity can be found here:
  https://undergrad.mst.edu/academicintegrity/studentresources-ai/

8.13   Student Well-Being

Link: https://wellbeing.mst.edu/

Your well-being is important, and it contributes to your success in this course. At S&T, we provide resources to support your mental, physical, and social well-being. Any of us can experience challenges that make learning difficult. If you are struggling, take advantage of the following resources offered by the university:

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[5]Ref. https://registrar.mst.edu/academicregs/index.html

Student Well-Being provides counseling services, health promotion initiatives, and prevention programs to empower the S&T community to thrive and enhance personal, academic, and professional success. Department office hours are Monday-Friday, 8 a.m. – 5:00 p.m. On the website, you can find information related to confidential individual and group counseling, wellness consultations and training, resources for many health and wellness topics, and help for mental health crisis situations.

For the National Suicide Prevention Lifeline, call or text 988, or visit missouri988.org.

8.14 Health and Well-Being Canvas Course

Link: https://umsystem.instructure.com/enroll/G3LY3G

The Health and Well-Being Canvas Course features trainings, presentations, and other health and well-being resources for students. The course is free for all students, is non-credit, and students can enroll at any point in the semester.

8.15 Student Support and Community Standards

Student support and community standards is your "Google Maps" for support. During your time at S&T, you or a friend may need help navigating the student experience, facing a barrier, or experiencing a challenge. You are not alone!

Student Support has a dedicated team and numerous resources such as UCARE and the student emergency fund to help you navigate the S&T experience and support your success. This includes support to address barriers related to academic, personal, emotional, medical, financial, or any other needs.

8.16 Nondiscrimination, Equity, and Title IX

Missouri S&T is committed to the safety and well-being of our campus community, and to creating an environment free from discrimination and harassment.

The University prohibits discrimination and harassment on the basis of race, color, national origin, ancestry, religion, sex, pregnancy, sexual orientation, gender identity, gender expression, age, disability, protected veteran status, and any other status protected by applicable state or federal law. As used in this policy, the word "sex" is also inclusive of the term "gender."

Additionally, US Federal Law Title IX states that no member of the university community shall, on the basis of sex, be excluded from participation in, or be denied benefits of, or be subjected to discrimination under any education program or activity. Sexual harassment violations of this law include quid pro quo, hostile environment, sexual assault, dating/domestic violence, and stalking. The U.S. Department of Education has stated the prohibition on discrimination on the basis of sex includes sexual orientation and gender identity.

Students who are experiencing pregnancy or pregnancy-related conditions, including the birthing parent and non-birthing parent, have rights protected under Title IX. Students should contact the Office of Equity and Title IX to learn more about their rights and pregnancy-related assistance/accommodations provided by the University to ensure equitable access to University educational programs and activities.

In accordance with the University of Missouri's Collected Rules and Regulations, all faculty and staff are required to report any information concerning discrimination disclosed through communication including, but not limited to, direct conversation, email, social media, classroom papers and homework exercises to the Equity Officer/Title IX Coordinator.

For more information regarding support for those that have been impacted or to report an incident of discrimination or harassment as defined by Chapter 600 of the University's Collected Rules and Regulations, visit the Office of Equity and Title IX or visit their website at equity.mst.edu.

Office of Equity and Title IX Equity Officer and Title IX Coordinator: Dr. Paul Hirtz
Phone: (573) 341-7734
Location: 900 Innovation Drive, Suite 500
E-mail: equity@mst.edu

8.17   Classroom Egress Maps

For all in-person instruction, faculty should explain where the classroom emergency exits are located. Classroom egress maps are posted at http://designconstruction.mst.edu/floorplan/.

8.18   Learning Assistance through LEAD

The Learning Enhancement Across Disciplines (LEAD) program runs Learning Centers and Tutoring which provide an efficient means to improve your understanding and increase your mastery of the material you are studying. Discipline-based faculty and undergrad peer instructors operate open-environment learning centers in nearly every foundational course as well as many upper-level courses. See the schedule for LEAD learning assistance at https://lead.mst.edu/schedule/.

8.19   Writing Center

The Writing Center's mission is to assist all students in their efforts to become better writers, communicators, and critical thinkers. The Writing Center's peer consultants and writing coaches provide free individualized one-on-one and small-group conversations to offer meaningful feedback and guidance to students across all disciplines. More information can be found on our website, through email: writing@mst.edu or stop by Curtis Laws Wilson Library 314–315.

8.20   Student Success Center

The Student Success Center (SSC) supports student development through peer Academic Mentoring focusing primarily on STEM courses, Peer-to-peer soft skill coaching which can also act as an accountability buddy, and campus programming – all while providing free coffee and hot beverages! All undergraduate students are encouraged to utilize the SSC's free services to get timely support and to enhance their S&T Miner Experience. Visit the SSC at 198 Toomey Hall, contact us at success@mst.edu OR 573-341-7590. To see the course offerings and times for SSC Tutoring, visit https://studentsuccess.mst.edu/academicmentoring/.

8.21   Knack Tutoring

Link: https://mst.joinknack.com/

With Knack Tutoring, any enrolled undergraduate student at S&T can get FREE help from a fellow miner who already took the class 24/7. You can choose to meet online on the Knack platform or on campus in person. If you've aced a course, sign up as a Knack Tutor to help your peers!

8.22   Student Veterans Resource Center

The Student Veterans Resource Center (SVRC) is the nexus of resources and support for student veterans at S&T. The SVRC provides student veterans with a "safe space" and a familiar atmosphere. The center's Veteran Consuls provide one-on-one consultations to guide students to various resources on campus, while its advisor provides students with VA health and benefits resources. Visit the SVRC at Harris Hall, Suite G10, and contact us at svrc@mst.edu.