Missouri University of Science and Technology — Department of Computer Science
Fall 2019 — **CS 5001: Game Theory for Computing**

SYLLABUS

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

1 Course Information

Course Website:	https://sites.google.com/a/mst.edu/nadendla/teaching/game-theory
Lecture hours:	Tuesdays & Thursdays; 2:00 PM - 3:15 PM
Lecture Venue:	Room 216, Computer Science Building
Instructor's Office:	313 Computer Science Building
Instructor's Office hours:	TBD.
Instructor's Contact Details:	nadendla@mst.edu, (573) 341-4090

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. Therefore, students are not mandated to buy textbooks. 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.
- 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.
- 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.

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

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	3
Basic Models	Normal-Form, Extensive Form, Bayesian Games	5
Solution Concepts	Nash Equilibrium, Subgame Perfect Equilibrium	5
Midterm 1	*First Week of October*	1
Dynamic Games	Repeated Games, Evolutionary Games	5
Coalitional Games	Transferable Utility, Core, Shapley Value	3
Mechanism Design	Revelation Principle, Incentive Compatibility, Social Choice	5
Midterm 2	*Week before Thanksgiving Break*	1
Project Presentations	(Out-of-class slots may be considered, if needed)	2

7 Grading Information

Students' grades will be calculated based on their 5 top-scored bi-weekly homework assignments, two midterm examinations, 5 top-scored quizes and a project, as shown below:

Assignments (Top-5):	40% of total grade
Midterm Exam (2):	30% of total grade
Quizzes (Top-5):	10% of total grade
Project (1):	20% of total grade
Final Grade for Undergrad Students:	$[90-100]$: A, $[80-90)$: B, $[70-80)$: C, $[60-70)$: D, <60: F
Final Grade for Grad Students:	$[90-100]$: A, $[80-90)$: B, $[70-80)$: C, <70: F

All the grades will be posted and maintained on Canvas.

8 Course Policies & Campus Resources

8.1 S&Tconnect

The purpose of the S&Tconnect Early Alert system (see the S&Tconnect tab in Canvas) is to improve the overall academic success of students by improving communication among students, instructors and advisors; reducing the time required for students to be informed of their academic status; and informing students of actions necessary by them in order to meet the academic requirements in their courses.

8.2 Disabilities

It is the university's goal that learning experiences be as accessible as possible. If you have a documented disability and anticipate needing accommodations in this course, you are strongly encouraged to meet with the instructor as early as possible in the semester. You will need to request that the Disability Support Services staff send a letter to the instructor verifying your disability and specifying the accommodation you will need before the instructor can arrange your accommodation. Disability Support Services is located in 203 Norwood Hall, their phone number is 573-341-6655, and their E-mail is sdsmst@mst.edu. Please visit http://dss.mst.edu/ for more information, or you can also initiate the accommodation process at https://mineraccess.mst.edu

8.3 Student Success Center

The Student Success Center is a centralized location designed for students to visit and feel comfortable about utilizing the campus resources available. The Student Success Center was developed as a campus wide initiative to foster a sense of responsibility and self-directedness to all S&T students by providing peer mentors, caring staff, and approachable faculty and administrators who are student centered and supportive of student success. Visit the SSC at 198 Toomey Hall; phone: 573-341-7596; E-mail: success@mst.edu; facebook: https://www.facebook.com/SandTssc; web: https://studentsuccess.mst.edu/

8.4 Student Honor Code & Academic Integrity

Every student enrolled in this course is expected to be familiar with both the Student Honor Code (which can be found on http://stuco.mst.edu/honor-code/), and Missouri S&T's Student Academic Regulations (available on Page 30 of the Student Academic Regulations handbook), which describes the student standard of conduct relative to the University of Missouri System's Collected Rules and Regulations section 200.010, and offers descriptions of academic dishonesty including cheating, plagiarism or sabotage. Incidences of

Academic Dishonesty will typically receive no credit for the respective course components, in addition to sending a notification to the respective student's advisor, the student's department chair, and the campus undergraduate studies office. Further academic sanctions may be imposed as well in accordance with the regulations. Those who allow others to copy their work will also be treated in the same manner.

Please note that student submissions are checked against each other with software that is VERY good at detecting similarities and differences between any text files, including your source files. These methods are difficult, if not impossible to trick. Therefore, students should not try to copy-paste, share sources directly, or write code in a group or pair for individual assignments. However, if help is taken from any source, students should cite them.

8.5 Classroom Egress Map

Please familiarize yourself with the egress map for the classroom (Room 216, Computer Science Building) posted at:
https://designconstruction.mst.edu/media/campussupport/designconstruction/secure/floorplan/R0055.pdf

8.6 Title IX

Missouri University of Science and Technology is committed to the safety and well-being of all members of its community. 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. Furthermore, in accordance with Title IX guidelines from the US Office of Civil Rights, Missouri S&T requires that all faculty and staff members report, to the Missouri S&T Title IX Coordinator, any notice of sexual harassment, abuse, and/or violence (including personal relational abuse, relational/domestic violence, and stalking) disclosed through communication including but not limited to direct conversation, email, social media, classroom papers and homework exercises.

Missouri S&T's Title IX Coordinator is interim chief diversity officer Neil Outar. You can reach him via email at naoutar@mst.edu; or via phone at (573) 341-6038; or find him at Temporary Facility A-1200 N. Pine Street to report Title IX violations. To learn more about Title IX resources and reporting options (confidential and non-confidential) available to Missouri S&T students, staff, and faculty, please visit http://titleix.mst.edu.