



GOSHEN COLLEGE
MATHEMATICS DEPARTMENT
MATH 250 GAME THEORY & MATH 350 ADVANCED GAME THEORY
FALL 2023-24

Catalog Description	Mathematical models of interactions among players: people, companies, nations, or genes. Concepts include strategy, preferences, equilibrium, efficiency, solutions, and fairness properties. Applications to biology, business, economics, politics, psychology, and theology are explored. Math 250 and Math 350 are taught simultaneously. Math 250 emphasizes modeling and application of techniques and has a prerequisite of Math 170. Math 350 emphasizes derivation and justification for game theory techniques and has a prerequisite of Math 211 and either Math 205 or 212. (3 credit hours)
Learning Objectives	The student will <ol style="list-style-type: none">1. Model real-world scenarios as games and interpret game solutions in the context of the scenario;2. Analyze games using a variety of solution concepts and mathematical techniques;3. Prove or disprove conjectured properties of games and solutions;4. Learn mathematics by reading, listening, exploring, and conversing in an effective manner;5. Explain and critique mathematical reasoning through speaking and writing in a precise and articulate manner in both informal and formal settings;6. Exhibit curiosity, playfulness, creativity, confidence, perseverance, interest in multiple perspectives, and a collaborative spirit.
Instructor	David Housman, SC 117, dhousman@goshen.edu, 574-535-7405 Hours when he is available in his office are posted on his office door and on Moodle.
Class Time	MWF 2:00 – 2:50 PM in WY 123
Textbook	<i>A Brief Introduction to Game Theoretic Modeling</i> by Rick Gillman and David Housman, CRC Press, 2019, ISBN 9781482248098 (hardback) or 978131515880 (eBook). A copy is on Good Library reserve, and the first two chapters are available on Moodle as a pdf. <i>Models of Conflict and Cooperation</i> by Rick Gillman and David Housman, American Mathematical Society, 2009 is a good optional resource especially if you are looking for a lower level treatment. A copy is on Good Library reserve.
On-line	Moodle moodle.goshen.edu Math 350 contains all information for both courses. Announcements posted to the forum will be emailed to all students. When necessary, David's Zoom Link will be used for remote students during class and office hours.
Software	SageMath (sagemath.org) and its collaborative notebook interface CoCalc (cocalc.com) will be used for computation. Free basic private server access will be provided. Gambit: Software Tools for Game Theory (http://www.gambit-project.org/) will also be used to easily calculate equilibria in sequential and strategic games.
Notebook	A three-ring binder with loose-leaf lined and graph paper is recommended so that you can keep a written record of problem-solving attempts, questions, math discoveries, and skill assessments.
Activities	The study of mathematics is not a spectator sport! Reading, listening, solving problems, writing explanations, reflecting upon ideas, and receiving feedback are essential to learning mathematics. Read with paper and pencil in hand, and take an anticipatory approach: try to obtain solutions, explanations, and proofs before reading what the author provides. Write down specific questions when you do not understand a portion of the text or a lecture. Try to recreate the key ideas, solve

problems, and write proofs without looking at the book or notes.

Moodle will announce what should be read and done in preparation for class. Class time will be devoted to activities intended to deepen and extend your understanding. The assignments should solidify your knowledge and strengthen your ability to apply that knowledge. A project will have you deeply investigate one aspect of game theory or apply game theory to one scenario of interest.

An average student can obtain an average grade with an average of nine hours each week devoted to this 3-credit hour course (including class time)—adjust if you are not average or desire a grade that is not average.

Grading	Course grades will be based on performance on class participation (10%), assignments (60%), and a project (30%).
Class Participation	Come to class prepared, be attentive and respectful, engage in activities, offer ideas, ask relevant questions, and suggest possible answers. Success in game play will also be important.
Assignments	<p>Achieve and exhibit understanding by completing the assigned exercises. Your solutions will be evaluated on the correctness of your mathematical descriptions and arguments, the clarity of your writing, and the quality of your presentation.</p> <p>Assignments are typically due a few days after the class during which the corresponding topic was discussed. Individual exercise solutions can be resubmitted or submitted late by the class period after the first submissions are graded and returned to students, but a 30% penalty will be assessed on these resubmissions and late submissions. When resubmitting work, include the originally graded work. A core set of exercises will be assigned for all students to complete. Math 250 students may be assigned additional computational or modeling exercises. Math 350 students may be assigned additional proof-oriented or more sophisticated exercises.</p> <p>You are encouraged to collaborate and seek assistance when having difficulties. You will have achieved the expected level of understanding when you are able to obtain your own solutions, independently reproduce solutions developed in collaboration or with assistance, and/or explain a solution to others.</p>
Project	Examine some game theory topic in greater depth, either individually or collaboratively. The final product will consist of a paper, group member evaluations, and a public presentation scheduled during the final exam period (Thursday, December 8, 8:00 – 10:00 AM). Potential topics, mechanics, and grading criteria should be discussed with the instructor starting early March culminating in a written proposal by March 31. Details are available on Moodle.
Extra Credit	Receive extra credit toward your assignments grade by doing one or more of the following: (1) find errors in the text or posted course materials and describe the error in writing; (2) attend a quantitative presentation (e.g., Science Speakers) or participate in a quantitatively based activity and describe in writing some interesting mathematical aspect of the presentation or activity; or (3) participate in a Career Services event and describe your most important discovery. The description should be a substantive paragraph or two and be submitted to the instructor on paper.
Tutoring Assistance	The Academic Success Center provides tutoring and writing support for free to all undergraduate students. Make an appointment at tutorcal.goshen.edu . Unfortunately, no current student has previously taken this course. Therefore, your best bet to receive assistance is to make use of David's office hours.
Accessibility Accommodations	Goshen College is committed to providing all students equitable access to programs and facilities. Students who need accommodations based on disability should contact the Academic Success Center (ASC). Students must register with the ASC before faculty are required to provide reasonable accommodations. For more information or to register, please contact the Director of Academic Success, Michelle Blank, Good Library 112, mblank@goshen.edu or 574-535-7526. To ensure that learning needs are met, contact the ASC the first week of classes. More information at: https://www.goshen.edu/campuslife/asc/disability-services/ .

**Collaboration
and
Academic
Integrity**

You are encouraged to use all available resources in order to learn the concepts and techniques discussed in this course. In particular, conversations with other students and the instructor can be an effective learning method. Reading other books and web pages can be another effective learning method. However, copying someone else's work subverts the learning process.

For assignments and the project, you may look at and discuss another student's work, but any written work developed during collaboration with another student should be destroyed before writing your own solutions. You should give written acknowledgement to people with whom you have had discussions and to any written materials (other than the text) that were helpful.

Failure to observe the above rules will result in a zero on the assignment or exam. Any violation of academic integrity will be reported to the Academic Dean. Observation of the above rules will help you learn the material well and give you the satisfaction of knowing that you have earned your grade.

Due Date Policy

Class participation, assignments, and the project can only be excused, rescheduled, or made up if (1) there is a serious medical problem, a death in the immediate family, or an irreconcilable conflict with another official Goshen College activity; (2) there is written documentation signed by proper authorities; and (3) the instructor is notified prior to the due date or as soon as possible afterwards.

**Course
Materials are for
Private Use**

Course materials (videos, assignments, exams, problem sets, etc) are for use in this course only. You may not upload them to external sites, share with any person outside this course, or post for public commentary without written permission from the professor. Sharing recordings outside of the class could lead to a copyright or FERPA violation. Goshen College prohibits any student from duplicating, downloading, or distributing class recordings with anyone outside of this class, for any reason.

**Student Life
Resources**

Goshen College is committed to providing a safe, supportive, and equitable learning environment. If you encounter circumstances that impact your learning or personal safety, please contact someone from [Student Services](mailto:studentservices@goshen.edu) (studentservices@goshen.edu or 574.535.7474).

- Any student who has difficulty accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Dean of Students Gilberto Pérez Jr. (gperez@goshen.edu or 574.535.7434) for support.
- Adriana Ortiz, Director of Hispanic Student Recruitment and Family Engagement, is available to help commuter students (aortiz@goshen.edu or 574.535.7291).
- Resident Directors Kevin Schultz (kevints@goshen.edu or 574.535.7286) and Jordan Blank (jblank@goshen.edu or 574.535.7296) are available to assist residential students.
- If you experience safety issues on campus, please contact Chad Coleman, Director of Campus Safety (chadc@goshen.edu or 574.535.7292).

Goshen College does not condone and will not tolerate inappropriate conduct toward any individual based on the individual's sex, sexual orientation, national origin, race, ethnicity, documentation status or gender identity. Issues related to [gender](#) and [racial](#) discrimination or harassment can be reported online. You may also contact Dean of Students Gilberto Pérez Jr. (gperez@goshen.edu or 574.535.7434) or Deputy Title IX Coordinator Liz Andes (landes@goshen.edu or 574.535.7484).