Tulane University
Department of Economics
ECON 4410 / 6410
Mathematical Economics
Spring 2022

Professor: Patrick Testa
Course hours: Tuesdays and Thursdays, 3:30-4:45pm
Course location: Stanley Thomas Hall 102
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ZOOM office: tulane.zoom.us/j/2087148040
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Overview

Economists study individual optimization and its aggregation, such as in markets with many individuals and firms. This course will introduce students to the mathematical tools and concepts used in the study of economic theory as well as other applications of rational choice theory. This course is intended for advanced undergraduate students and students in the master's program in economics. Students should have prior training in intermediate microeconomics and integral calculus (i.e. MATH 1210 or 1310). It is also helpful to have a background in basic probability theory, although it is not necessary.

Course goals and objectives

The goals of this course are:

- Expose students to important methods, models, and applications of mathematics to the study of economics.
- Teach students how to formalize economic theory in the form of mathematical models.
- Introduce students to some of the strengths as well as limitations of mathematical modeling for understanding and predicting real-world phenomena.

As a result of this course, students will be able to:

- Analyze problems in economics as well as in politics and other social contexts using mathematical models.
- Develop their own basic mathematical models to study economic decision-making in the real world.
- More comfortably pursue further education in economic theory, such as at Ph.D. level.

Texts

The following is required reading (believe me, it is a phenomenal resource!):

- Simon and Blume, *Mathematics for Economists*. Norton.

I also recommend the following:

- Schaum. *Introduction to Mathematical Economics*. McGraw-Hill.
- Chiang and Wainwright. *Fundamental Methods of Mathematical Economics*. McGraw-Hill.
- De La Fuente. *Mathematical Methods and Models for Economists*. Cambridge University Press.

For a more advanced text, see:

- Varian. *Microeconomic Analysis*. Norton.
- Mas-Colell, Whinston, and Green. *Microeconomic Theory*. Oxford University Press.

Grades

Grades will be based on either (i) five problem sets (25%), two midterm exams (20% each), and a cumulative final exam (35%), or (ii) five problem sets (25%) and the final exam (75%), whichever is greater. Students in the master's portion will be subject to different (i.e. more rigorous) exams. Grades will follow the typical system ($\geq$93% is A range, 90-92.5% is an A$-$, 87-89.5% is a B+, etc.).

Attendance policy

Students should attend class and take notes so that they are aware of assignments and deadlines as well as any scheduling changes that may arise. Students should communicate to me via email when they will be absent and rely on office hours (please come see me!) as well as help from peers to fill in any blanks. Only a formal note from a doctor may qualify a student to delay any deadline. If a student must miss an exam otherwise, they may opt for the second grading plan as outlined above.

COVID-19 policy

Lecture will be in-person only by default. We will move online in the event of any college- or university-wide policy change regarding in-person lecture. If you are sick (with COVID or otherwise) and cannot attend, you will not be penalized. However, you will be expected to keep up with the reading material and rely on peers and office hours to make up for other missed course materials. Only a formal note from a doctor may qualify you to delay any deadline. Masks are required conditional on a university-wide mask mandate and optional otherwise. Failure to comply is a violation of the Code of Student Conduct and students will be subject to University discipline, which can include suspension or permanent dismissal. Please see tulane.edu/covid-19/health-strategies for University policies regarding COVID-19 testing and isolation. Masking and other COVID-19 policies are subject to change.

ADA/Accessibility

Tulane University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability, please let me know immediately so that we can privately discuss options. I will never ask for medical documentation from you to support potential accommodation needs. Instead, to establish reasonable accommodations, I may request that you register with the Goldman Center for Student Accessibility. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. Goldman Center contact information: goldman@tulane.edu, accessibility.tulane.edu, or (504) 862-8433.

Code of academic conduct

The Code of Academic Conduct applies to all undergraduate students, full-time and part-time, in Tulane University. Tulane University expects and requires behavior compatible with its high standards of scholarship. By accepting admission to the university, a student accepts its regulations (i.e., Code of Academic Conduct and Code of Student Conduct) and acknowledges the right of the university to take disciplinary action, including suspension or expulsion, for conduct judged unsatisfactory or disruptive.

Statement of equity, diversity, and inclusion

Equity, diversity, and inclusion (EDI) are important Tulane values that drive excellence in our learning environments and help us build a supportive culture and climate for every member of our community. Diversity refers to many different identities and experiences that include the following and more: race, color, sex, religion, national origin, age, disability, genetic information, sexual orientation, gender identity, gender expression, pregnancy, marital status, military status, veteran status (or any other classification protected by applicable law). To live our values of EDI with one another, we acknowledge that each of us have areas of strength and growth in our EDI learning and competency that we each continuously work on to sustain EDI on our campus.

Religious accommodation policy

Per Tulane's religious accommodation policy and our core values of diversity and inclusion, I will make every reasonable effort to ensure that students are able to observe religious holidays without jeopardizing their ability to fulfill their academic obligations. Excused absences do not relieve the student from the responsibility for any course work required during the period of absence. Students should notify me within the first two weeks of the semester about their intent to observe any holidays that fall on a class day or on the day of the final exam.

Course outline

Part I: Methods
Introduction and notation
Functions
Limits
Differentation
Differentation with multiple variables
Implicit differentiation
Sums and integrals
Optimization with one variable
First and second order conditions
Unconstrained optimization
Constrained optimization and LaGrange multipliers
Optimization with multiple variables
Applications of matrix algebra

Part II: Models
The rational choice approach to modeling human behavior
Preference relations
Consumer choice under perfect information
Utility functions and the sufficiency of ordinality
Multivariate utility functions and indifferent curves
Convex preferences and quasi-concave utility
Consumer choice under imperfect information
Expected utility
Risk attitudes
Firm choice, production functions, and isoquants
Returns to scale and diminishing marginal returns

Part III: Applications
Producer theory
Profit maximization
Consumer theory
Utility maximization with multiple goods
Pure exchange economies
Walrasian equilibrium
Equilibrium with consumer demand and firm supply
Game theory and Nash equilibrium

Course schedule

Problem set I due (February 9)

Problem set II due (February 21)

Midterm exam I (February 24)

Mardi Gras break (March 1)

Problem set III due (March 16)

Spring break (March 28 - April 1)

Problem set IV due (April 6)

Midterm exam II (April 12)

Problem set V due (April 27)

Final exam (May 7 at 12pm)

Note: dates and order of material may be subject to change.

Title IX

Tulane University recognizes the inherent dignity of all individuals and promotes respect for all people. As such, Tulane is committed to providing an environment free of all forms of discrimination including sexual and gender-based discrimination, harassment, and violence like sexual assault, intimate partner violence, and stalking. If you or someone you know has experienced or is experiencing these types of behaviors, know that you are not alone. Resources and support are available: you can learn more at `http://allin.tulane.edu`. Any and all of your communications on these matters will be treated as either "Confidential" or "Private" as explained in the chart below. Please know that if you choose to confide in me I am mandated by the university to report to the Title IX Coordinator, as Tulane and I want to be sure you are connected with all the support the university can offer. You do not need to respond to outreach from the university if you do not want. You can also make a report yourself, including an anonymous report, through the form at `http://tulane.edu/concerns`.

Confidential	Private
Except in extreme circumstances, involving imminent danger to one's self or others, nothing will be shared without your explicit permission.	*Conversations are kept as confidential as possible, but information is shared with key staff members so the University can offer resources and accommodations and take action if necessary for safety reasons.*
Counseling & Psychological Services (CAPS) | (504) 314-2277 or The Line (24/7) | (504) 264-6074	**Case Management & Victim Support Services | (504) 314-2160 orsrss@tulane.edu**
Student Health Center | (504) 865-5255	**Tulane University Police (TUPD) | Uptown - (504) 865-5911. Downtown – (504) 988-5531**
Sexual Aggression Peer Hotline and Education (SAPHE) | (504) 654-9543	**Title IX Coordinator | (504) 314-2160 or msmith76@tulane.edu**

Emergency preparedness and response

EMERGENCY NOTIFICATIONS: TU ALERT	SEVERE WEATHER
In the event of a campus emergency, Tulane University will notify students, faculty, and staff by email, text, and/or phone call. You were automatically enrolled in this system when you enrolled at the university. Check your contact information annually in Gibson Online to confirm its accuracy.	▪ Follow all TU Alerts and outdoor warning sirens ▪ Seek shelter indoors until the severe weather threat has passed and an all-clear message is given ▪ Do not use elevators ▪ Do not attempt to travel outside if weather is severe Monitor the Tulane Emergency website (tulane.edu/emergency/) for university-wide closures during a severe weather event
ACTIVE SHOOTER / VIOLENT ATTACKER	**EVERBRIDGE APP**
▪ **RUN** – run away from or avoid the affected area, if possible ▪ **HIDE** – go into the nearest room that can be locked, turn out the lights, and remain hidden until all-clear message is given through TU ALERT ▪ **FIGHT** – do not attempt this option, except as a last resort ▪ For more information or to schedule a training, visit emergencyprep.tulane.edu	▪ Download the Everbridge app from the App Store or Google Play store ▪ The Report feature allows you to silently and discreetly communicate with TUPD dispatchers ▪ The SOS button allows you to notify TUPD if you need help ▪ The Safe Corridor button serves as a virtual escort and allows you to send check-in notifications to TUPD