INSTRUCTOR: Professor Dora Gicheva
Office: 459 Bryan Building
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Virtual Office Hours: Thursday 10am – 12pm or by appointment

COURSE DESCRIPTION: This course is designed to provide the mathematical foundations necessary for the PhD theory sequence. It provides an introduction to mathematical modeling and optimization in economics. The first part of the course reviews and introduces new mathematical concepts useful in economics. The second part of the course focuses on choice under uncertainty and intertemporal optimization.


I will also use Microeconomic Theory by Mas-Colell, Whinston and Green. There will be additional readings from other textbooks and journal articles. I will make such readings available to you.

I will usually post brief lecture notes on the UNCG Canvas website prior to lecture. You should print them out and go over them before class. Bringing them to class will make it easier for you to take notes.

The required software for this class is MATLAB®. There are several ways to access and use MATLAB:
1. You can purchase a copy of MATLAB to use on your personal computer. The price of the basic student version is $49. We will use the following add-ons:
   - Optimization Toolbox
   - Symbolic Math Toolbox
   http://www.mathworks.com/academia/student_version/
   There is a discount if you purchase add-ons at the same time as the MATLAB software.
2. You can use MATLAB in the computer labs on campus.
**Course Objectives:** By the end of this course students should have the mathematical background necessary to complete a graduate-level sequence in microeconomic theory. Students will learn about the following:

- Properties of sets; open and closed sets
- Functions of several variables; differentiation of multivariate functions
- Implicit functions
- Definite matrices
- Constrained and unconstrained optimization; Kuhn-Tucker conditions
- Homogeneity and homotheticity
- Concave and quasiconcave functions
- Eigenvalues and eigenvectors
- Choice under uncertainty
- Money lotteries and risk aversion
- Bellman equations
- Intertemporal optimization with uncertainty
- Search models

**Grades:** Grades will be based on the following components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Homework</td>
<td>20%</td>
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<tr>
<td>Exams</td>
<td>35% each</td>
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<tr>
<td>Presentations</td>
<td>10%</td>
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**Homework:** I will usually assign problem sets weekly, although sometimes I may skip a week and assign a longer problem set the following week. Most problem sets will have a programming component, which should be completed using MATLAB®. You should turn in a printout of your (well-documented and clearly written) program, as well as a concise printout of the output. You can work on the homework assignments in groups but you have to write up your own solutions. All homework is due at the beginning of class; no late homework will be accepted.

**Exams:** There will be two take-home exams. The second exam will be given during final’s week (Nov. 30–Dec. 5) and is not cumulative. The two exams will contribute equal weights toward your semester grade. I will provide more information about the exams in class.

**Presentations:** Presentations will take place during the last two class periods: November 17 and 19. I will provide more details in class.
COURSE OUTLINE

1. Notation and definitions
   a. Sets, numbers and proofs (SB Appendix 1)
2. Review of matrix and vector algebra (SB 8 – 11)
3. Limits and open sets (SB 12, MWG M.F)
4. Functions of several variables (SB 13)
5. Calculus of several variables (SB 14, MWG M.A)
6. Implicit functions and their derivatives (SB 15, MWG M.E)
7. Positive and negative (semi-)definite matrices (SB 16, MWG M.D)
8. Unconstrained optimization (SB 17, MWG M.J)
9. Constrained optimization (SB 18, 19; MWG M.K, M.L)

First Exam

10. Homogeneous and homothetic functions (SB 20, MWG M.B)
11. Concave and quasi-concave functions (SB 21, MWG M.C)
12. Choice under uncertainty (MWG 6)
13. Dynamic programming: cake eating example (AC p.7-20)
15. Optimal stopping (AC p.22-24, 175-179, 205-209)
16. Search models (AC p.257-262)

Second Exam: November 30 – December 5

SB – Simon and Blume;
MWG – Mas-Colell, Whinston and Green;
AC – Adda and Cooper
**Academic Integrity Policy:** Students are expected to know and abide by UNCG’s Academic Integrity Policy in all matters pertaining to this course. Violations will be pursued in accordance with the Policy. Please visit the UNCG Academic Integrity webpage and read the Academic Integrity Policy.

**Accommodations:** UNCG seeks to comply fully with the Americans with Disabilities Act (ADA). Students requesting accommodations based on a disability must be registered with the Office of Accessibility Resources and Services (OARS) in 215 Elliott University Center, 334-5440, oars.uncg.edu.

Students may request accommodations for religious holidays under applicable laws. See https://catalog.uncg.edu/academic-regulations-policies/university-policies for more information.

Students should remind the instructor in advance when accommodation affects course activities, e.g., before taking exams, to ensure that the instructor has updated systems accordingly.

**Health and Wellness:** Health and well-being impact learning and academic success. Throughout your time in the university, you may experience a range of concerns that can cause barriers to your academic success. These might include illnesses, strained relationships, anxiety, high levels of stress, alcohol or drug problems, feeling down, or loss of motivation. Student Health Services and The Counseling Center can help with these or other issues you may experience. You can learn about the free, confidential mental health services available on campus by calling 336-334-5874, visiting the website at https://shs.uncg.edu/ or visiting the Anna M. Gove Student Health Center at 107 Gray Drive. For undergraduate or graduate students in recovery from alcohol and other drug addiction, The Spartan Recovery Program (SRP) offers recovery support services. You can learn more about recovery and recovery support services by visiting https://shs.uncg.edu/srp or reaching out to recovery@uncg.edu.

**Faculty and Student Guidelines** can be found at https://bryan.uncg.edu/wp-content/uploads/2017/08/Faculty-and-Student-Guidelines-2018-2019.pdf. Please read them carefully in order to understand the roles and responsibilities of both students and faculty.

**Communication and Course Technical Guidelines:**
Technical support: Students with technical issues with the course and email should contact 6TECH for support either by email or phone or chat (https://its.uncg.edu/Help/6TECH/). Please also make your instructor aware of the issue, and if there will be any delays in resolving the issue.

**Behaviors That Limit the Spread of COVID-19**
As UNCG returns to face-to-face course offerings in fall 2020, the campus community must recognize and address concerns about physical and emotional safety. As such, all students, faculty, and staff are required to uphold UNCG’s culture of care by actively engaging in behaviors that limit the spread of COVID-19. Such actions include, but are not limited to, the following:

- Wearing a face covering that covers both nose and mouth
- Observing social distance in the classroom
• Engaging in proper hand washing hygiene when possible
• **Self-monitoring for symptoms of COVID-19**
• Staying home if you are ill
• Complying with directions from health care providers or public health officials to quarantine or isolate if ill or exposed to someone who is ill.

Instructors will have seating charts for their classes. These are important for maintaining appropriate social distance during class and facilitating contact tracing should there be a confirmed case of COVID-19. Students must sit in their assigned seat at every class meeting and must not move furniture. Students should not eat or drink during class time.

A limited number of disposable masks will be available in classrooms for students who have forgotten theirs. Face coverings will also be available for purchase in the UNCG Campus Bookstore. Students who do not follow masking and social distancing requirements will be asked to put on a face covering or leave the classroom to retrieve one and only return when they follow these basic requirements to uphold standards of safety and care for the UNCG community. Once students have a face covering, they are permitted to re-enter a class already in progress. Repeated issues may result in conduct action. The course policies regarding attendance and academics remain in effect for partial or full absence from class due to lack of adherence with face covering and social distancing requirements.

For instances where the Office of Accessibility Resources and Services (OARS) has granted accommodations regarding wearing face coverings, students should contact their instructors to develop appropriate alternatives to class participation and/or activities as needed. Instructors or the student may also contact OARS (336.334.5440) who, in consultation with Student Health Services, will review requests for accommodations.

**COVID-19 Spartan Shield Video**
UNCG Chancellor Frank Gilliam has challenged us to create a Culture of Care at UNCG where we all wear face coverings and social distance, less to protect ourselves but rather more to protect everyone around us. It shows that you care about the well being of everyone around you. We have created this video featuring your student body presidents to better explain how and why this is so important.

Please watch this video before the first day of classes: [https://youtu.be/Mb58551qxEk](https://youtu.be/Mb58551qxEk)