

# DSA: 8420 Advanced Mathematical Programming

Spring 2025

**Instructor:** Boshi Yang ([boshiy@clemsun.edu](mailto:boshiy@clemsun.edu))

**Modality:** online, asynchronous

**Office:** Martin O-204 (864-656-5198)

**Office Hours (Zoom):** Mondays 8:00–9:00 pm and by appointment. The Zoom link is available on Canvas.

**Time to Wait:** Please wait 10 minutes for any scheduled meeting if the instructor is late.

**Prerequisites:** Enrollment in the Data Science and Analytics Masters of Science program and DSA 8280.

**Course Description.** This course introduces the theory, methodology, and applications of linear, network and integer programming. Topics include model development, optimality concepts, solution methods, and computer tools.

**Course Overview.** The course is structured into seven units. Unit 0 is an introduction to this course and mathematical optimization. Unit 1 is a review of fundamental linear algebra concepts and methods relevant to optimization. The subsequent five units focus on the most important types of mathematical programs including linear programs, network programs, and integer programs. For each, students will study fundamental theory, methodology, and applications. Hands-on experience with software tools will support the application of concepts.

**Learning Outcomes.** Upon successful completion of the course, students will:

- be familiar with concepts of mathematical optimization,
- understand the source of the difficulty of optimization problems,
- be able to identify different classes of optimization problems,
- be able to solve small-size optimization problems analytically,
- be able to solve medium-size optimization problems using software, and
- be able to develop mathematical optimization models for various decision-making problems.

## Required Materials.

- Textbook: B. Kolman and R. E. Beck, *Elementary Linear Programming with Applications*, Second Edition, Academic Press, 1995.
- A computer with a camera and microphone.
- Software:

- Word processing program, PowerPoint, Adobe, scanner app to make PDF files. LaTeX is recommended for writing mathematics.
- Python, Jupyter Lab.
- Additional software instructions will be provided as needed

**Required Technical Skills.** To succeed in this course, students should:

- Have a foundational understanding of linear algebra.
- Possess basic Python programming skills.
- Be proficient with their computer system, web browser, word processing software, and spreadsheets.

For technical issues, contact [ithelp@clermson.edu](mailto:ithelp@clermson.edu) or visit <https://ccit.clemson.edu/support>.

**Learning Environment.** In this online course, students will have the chance to interact with the content, instructors, and classmates on a weekly basis through course assignments, asynchronous video lectures and/or synchronous office hours. Use the website <https://clermson.instructure.com> and follow links to our section of DSA 8420 in Canvas. This course section website will house all course materials. Students are responsible for checking this website and their university email account ([useridd@clermson.edu](mailto:useridd@clermson.edu) or [useridd@g.clemson.edu](mailto:useridd@g.clemson.edu)) regularly for announcements and class materials.

### **Tentative Topical Outline.**

Unit	Topic	# Weeks	Textbook
0	Introduction	1	
1	Linear Algebra	1.5	Chapter 0
2	Linear Programming: I	4.5	Chapters 1,2
3	Computer Tools	2	
4	Linear Programming: II	2	Chapter 3
5	Network Optimization	2	Chapter 5
6	Integer Programming	2	Chapter 4

The outline is subject to adjustments. Notes will be provided for topics not covered in the textbook.

### **Major Assessment Activities.**

- Homework Assignments. The weekly assignment helps students keep up with the class. Some questions will be graded on completion and others on accuracy.
- Projects. The projects enhance students' understanding with computational experience. Students can work on 2-person teams or individually.

**Grading Policies.** The final grade will be determined as the weighted average of the following graded activities:

Homework	Projects
70%	30%

There will NOT be an opportunity for individual students at the end of the semester to obtain extra credit for additional work beyond the work all students are expected to do throughout the semester.

**Late Work.** All assignments are due **Tuesday night (Eastern Time)**. Late submissions are accepted until **Friday night** with penalties:

Days Late	0 - 1	1 - 2	2 - 3	> 3
Score Deduction	5%	10%	20%	unacceptable

No late work will be accepted once the answer key is published (typically on Saturday).

**Grading System.**

90 to 100	75 to 90	60 to 75	less than 60
A	B	C	F

**Academic Integrity:** As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. See the [current graduate student handbook](#) for all policies.

**Accessibility:** Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities. Students who experience a barrier to full access to this class should let the instructor know and are encouraged to request accommodations through SAS (Student Accessibility Services) as soon as possible. To request accommodations through SAS, please see this link: [www.clemson.edu/academics/student-accessibility-services/how-to-register/requesting-accommodations](http://www.clemson.edu/academics/student-accessibility-services/how-to-register/requesting-accommodations). You can also reach out to SAS with questions by calling 864-656-6848, email [CUSAS@clemson.edu](mailto:CUSAS@clemson.edu) or visiting SAS at the ASC Suite 239. Contact the office for the most updated drop-in schedule if you would prefer not to schedule an appointment.

**The Clemson University Title IX Statement Regarding Non-Discrimination:** Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy or related conditions (including pregnancy, childbirth, termination of pregnancy, lactation, recovery from the foregoing, or medical conditions related to the foregoing), national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sex discrimination (including sex-based harassment and sexual violence) as mandated by Title IX of the Education Amendments of 1972. This [Title IX policy](#) is located on the Access Compliance and Education website. Ms. Alesia Smith is the Clemson University Title IX Coordinator, and the Assistant Vice President of Equity Compliance. Her office is located at 223 Brackett Hall, 864-656-3181 and her email address is [alesias@clemson.edu](mailto:alesias@clemson.edu). Remember, email is not a fully secured method of communication and should not be used to discuss Title IX issues.

**Academic Continuity Plan:** The university issues official disruption notifications through email, website, text notification and social media. When notified, use one of the following links to navigate to Clemson Canvas where you will find important information about how we will conduct class:

- Primary access link: [www.clemson.edu/canvas](http://www.clemson.edu/canvas)

- Secondary access link, if needed: <https://clemsontechsupport.com/>
- You can also use the Canvas Student App. Visit the [downloads](#) page for this app.

**Emergency Preparation:** Emergency & Safety Procedures have been posted in all buildings and on elevators. Students should be reminded to review these procedures for their own safety. All students and employees should be familiar with guidelines from [Clemson University Public Safety](#). Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

1. Ensure you are signed up for [emergency alerts](#) (CU Alerts). Alerts are only sent when there is a potential threat to safety, a major disruption to campus services, and for once monthly tests.
2. Familiarize yourself with all possible exits, safer locations, and other key information on the emergency evacuation maps in this building and those that you visit regularly.
3. Make a plan for how you would Run, Hide, and Fight in case of an [active threat](#) in this building and those that you visit regularly.
  - Run – What are all the possible exits in this building, and the routes to them?
  - Hide – What are the potential hiding locations in this room and building that are out of sight of doors and windows, how do you lock the door(s), how would you barricade the door(s) and windows, and where do you turn off the lights?
  - Fight – What tools are available in this room and building, should you have to fight?
4. Learn what you can do to [prepare yourself](#) for the hazards that affect our locations. (<https://www.clemson.edu/cusafety/emergency-management/emergency-procedures/index.html>)
5. Download the [Rave Guardian app](#) to your phone. (<https://www.clemson.edu/cusafety/cupd/services/rave-guardian-app.html>)