Syllabus ISE-530
Optimization Methods for Analytics
Spring 2025

Units: 4
Day: Tues/Thu 4:00 P.M.-5:50 P.M.
Location: DMC 156

Instructor:	Prof. Niloufar Izadinia
Email:	izadinia@usc.edu
Website:	https://viterbi.usc.edu/directory/faculty/Izadinia/Niloufar
Office Hours:	TBD, GER 202
	TBD on Zoom

Teaching Assistant:	TBD
Email:	
Office Hours:	

USC Catalogue Description
Fundamentals of Linear Programming, Integer Programming, quadratic and nonlinear programming for analytics and data science problems.

Course Description
This course covers the most common classes of optimization problems, their theory, and basic methods for its numerical solutions. The topics provide a set of fundamental tools for the understanding and solution of a variety of data-analytic problems including those arising from operations, statistics, machine learning, financial engineering, network science, and data-driven modeling.

Learning Objectives
At the end of this course, students will be able to:
- Describe the most common optimization problems (linear, quadratic, non-linear, and integer)
- Identify their mathematical properties, and basic algorithms for solving them
- Develop a set of tools to be applied to a variety of problems

Prerequisite(s): None
Co-Requisite(s): None
Concurrent Enrollment: None

Recommended Preparation
This course makes heavy use of linear algebra and matrix operations and assumes that you are comfortable with college-level mathematical reasonings typical of an engineering curriculum. If you are not comfortable with these background materials, either quickly review them or postpone taking the course until you are ready. In addition, make sure you are familiar with either MATLAB or Python or alternative coding for implementing algorithms that require matrix operation in homework assignments.

Course Notes

Students will be responsible for downloading the lecture notes for each lecture from the course website. All handouts, including homework, homework solutions, exams, etc. will be posted in the Brightspace course website. Additional readings and notes beyond the main texts used in the lectures will be provided by the instructor as needed.

Technological Proficiency and Hardware/Software Required

Access to a computer is required.

Recommended Texts:

• Richard W. Cottle and Mukund N. Thapa, *Linear and Nonlinear Optimization*, ISBN 978-1-4939-7053-7; Springer New York (2017).

• Gerard Cornuejols and Reha Tütüncü, *Optimization Methods in Finance*. Fourth Printing, Cambridge University Press. Available at
https://www.andrew.cmu.edu/user/gc0v/webpub/book.pdf

Grading Policy:

Homework	30%
Participation and Contribution	25%
Midterm	20%
Final exam	25%

Homework Assignments:

- Assignments are assigned on the second period of the week and **are due at midnight of Friday of the following week**, submitted through the assignment manager on **Brightspace** and will be returned electronically. Solutions will be posted after the assignment is due.

- **Late homework submissions are not accepted under any circumstances**. However, **two lowest scores will be dropped (a missed homework is a zero).**

- It's OK to work on individual homework assignments together but finish it by yourself and indicate whom you worked with. Each student must turn in a separate homework. Do not give your files to others, and do not use others' files. Do not copy solutions from people you have worked with or from anyone else. Generated data and essay questions must be unique to each student. If you use solutions from prior semesters, indicate that. **If the answer is given in a book, don't just copy it, explain how you got it.**

- The assignments should be as professional in appearance as if you were preparing reports at work or for publication.

Participation:

General:

This is intended to be an interactive class, and your participation should increase as the semester progresses. Students are expected to have read the preparation material and participate actively in the discussions and exercises in the class. You may find it difficult to follow the discussion if you have not read the material. **You should be prepared to**

devote the time necessary to take the course. The course material is cumulative, and you need to keep up as we go along.

In-class exercises and challenges:
There will be several in-class exercises and challenges that you should do during the class time.
Laptops, desktops, or iPads are required per group to do and submit these exercises. **The students do them in pre-assigned groups**.

Attending **all** classes for the **whole** duration of class is expected of everyone. Frequent absences will result in a reduction in grade. Punctuality is expected.

Examinations:

- The midterm and final will be based on homework assignments, the discussions, notes and in-class exercises. Students are expected to apply what they should have learned up to that point to analyzing situations, identifying the problems, and applying the appropriate techniques to solve them or interpreting computer solutions.
- The midterm and final exams are **open book and open notes** and **take home**.
- Calculators are OK but **laptops or desktops are required**[1].
- Exams are to be uploaded on **Brightspace**.
- The students will have **until the midnight of the next day of the exam** to take the exam on Brightspace.
- Note that the exams are not timed but the students have only **one attempt** to complete the exam.
- **There will be no class on the exam days.**

Test Schedule:

	Start	Due
Midterm	TBD	TBD at midnight
Final	Thursday, May 8, 4:30 PM	Friday, May 9, 11:59 PM

Course Outline:

The approximate breakdown for course material follows below:

- Introduction to optimization
- Modelling an optimization problem
- Linear programming and solution algorithms (Simplex, …)
- Duality theory and Sensitivity analysis
- Discrete (Integer) optimization modelling
- Basic Integer programming algorithms
- Unconstrained Optimization
- Nonlinear programming
- Dynamic programming (time permitting)

Important Notes:

- The syllabus may get updated during the semester.

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[1] https://itservices.usc.edu/spaces/laptoploaner/

- In all your emails to the instructor, copy the TAs as well to make sure you get the response as soon as possible.
- **Include "ISE 530"** at the beginning of all your email titles to get the response as soon as possible.
- **ALWAYS BE SURE TO GIVE THE SOURCE OF ALL YOUR INFORMATION. ANYTHING TAKEN VERBATIM FROM SOMEONE ELSE MUST BE IN QUOTATION MARKS AND REFERENCED. THIS INCLUDES PARTIAL SENTENCES.**
- Grading Scale Course final grades will be determined using the following scale

A	[94, 100]		C	[74, 77)
A-	[90, 94)		C-	[70, 74)
B+	[87, 90)		D+	[67, 70)
B	[84, 87)		D	[64, 67)
B-	[80, 84)		D-	[60, 64)
C+	[77, 80)		F	< 60

Statement on Academic Conduct and Support Systems

Academic Integrity:
The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call
The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1

(800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 740-0411
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call
Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-2850 or otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.