



Viterbi School of Engineering

As of Jan 6

ISE 536 Linear Programming and Extensions

Units: 3

Spring 2023, Wed 3-5:50 pm

Location: OHE 100B

Instructor: Dr. Parisay

<https://ise.usc.edu/directory/faculty/profile/?lname=Parisay&fname=Sima>

Office: online, Zoom link on the course's Blackboard

Office Hours: Wed 11 am-12 noon, and by appointment

Contact Info: parisay@usc.edu

Teaching Assistant: Yilin Zhu

Office: online, Zoom link on the course's Blackboard

Office Hours: Tues 7-8 pm, and by appointment

Contact Info: yilinzhu@usc.edu

IT Help:

Hours of Service:

Contact Info:

Catalog Course Description

Linear programming models for resource allocation; simplex and revised simplex methods; duality; sensitivity; transportation problems; selected extensions to large scale, multi-objective, and special structured models.

Learning Objectives

This course is designed for those with minimum background in this field and concentrates on application of these techniques.

Operations Research (OR) techniques to be covered are all deterministic linear mathematical models. Techniques to be covered: linear programming (LP) including simplex method, dual of LP, goal (multi-objective) programming (GP), integer programming (ILP), transportation, assignment, transshipment, and travel sales person (TSP).

Learning Objective	Assignment/Assessment tools used
By the end of this course, students should be able to:	This learning objective and skill is measured by:
Reproduce knowledge of several OR techniques (OR knowledge)	Quizzes at the beginning of each class based on the pre-recorded video lectures and handouts.
Employ OR software (Software skill)	Assigned homework, quiz, exam
Formulate several styles of LP problems (Formulation skill)	Math formulation in exam, homework, and class activities
Analyze software output (Analysis skill)	Essay in exam, homework, and class activities

Prerequisite(s): EE 441 (Applied Linear Algebra for Engineering), Math 225 (Linear Algebra and Linear Differential Equations)

Co-Requisite (s): None

Concurrent Enrollment: None

Recommended Preparation: None

Course Notes

This course will be conducted as a **Flipped Classroom**. There will be 1 or 2 pre-recorded video lectures each week that students have to watch and learn before the class. These videos will be accessible from the course web site. Each video will be around half-an-hour and will cover the basic knowledge about each topic. There will be handouts on the course web site to accompany these pre-recorded video lectures. The course materials (handouts and video lectures) will be on the course web site.

We will use class meetings (sessions) for lectures on Wednesdays to concentrate on more practice, answering common questions, and higher level of discussions. There will be class activities during these meetings. **IT IS REQUIRED TO BRING YOUR LAPTOP TO THE CLASS MEETINGS.**

Technological Proficiency and Hardware/Software Required

You will use a software of your choice to solve the problems. AMPL software will be covered for those interested.

Required Readings and Supplementary Materials

Required: Course Handouts and video lectures on Blackboard by Dr. Parisay.

Required textbook: W. L. Winston, "Operations Research, Application and Algorithms", 4th Edition, Thomson Learning (Brooks/Cole Publishing Co), 2004, ISBN-10: 0534380581 | ISBN-13: 9780534380588. This book can be purchased from the USC Book store or any other sources.

Description and Assessment of Assignments

- **Midterm exam I and II** will be based on the schedule and will take 1.5 hours. Make up exam is only considered under special situations with advance approval of instructor.
- **Final exam** will be held at the completion of all classes based on the University schedule and it takes 2 hours. Make up exam is only considered under special situations with advance approval of instructor.
- **Homework:** Homework will be assigned each week on Thursdays. You will post your answer as a Word file on Blackboard before the next class by 2 pm on Wednesdays (unless otherwise indicated). Late homework and makeup homework will be considered under special situations with advance approval of instructor. Makeup HW will not be the same HW or from the same topic. Homework is expected to be typed as much as possible and professionally done. Homework on average will take about 1.5 hours each week, depending on your background. The homework can be at different level of difficulty and take different amount of time. I will select **five** homework randomly for grading. Each homework will have 3 points. The **highest three** grades for homework will be considered. The final total grade from homework will be at most 9 points.
- **Quiz:** Quiz will be conducted at the beginning of each class on Wednesdays. Quiz will be based on the assigned pre-recorded video lecture and posted handouts on Blackboard. It will take about 10-15 min. Quiz can be as multiple-choice, some simple calculation, or short written essay. Makeup quiz will be considered under special situations with advance approval of instructor. Makeup quiz will not be the same quiz or from the same topic. The quizzes can be at different level of difficulty and take different amount of time. I will select **seven** quizzes randomly for grading. Each quiz will have 2 points. The **highest five** grades for quizzes will be considered. The final total grade from quizzes will be at most 10 points.
- **Class activity:** There will be different styles of in-class activities each session. It requires you be present and participate during the class session. There will be no makeup for these activities. I will select a few of these activities at the end of the semester for grading. This grade will be considered as 'extra credit'.

Grading Breakdown

Assignment	Points	% of Grade
Midterm exam I	25	25
Midterm exam II	25	25
Final Exam	31	31
Homework (3*3)	9	9
Quiz (5*2)	10	10
In-class activities as extra credit		
Total	100	100

Total points will be curved for the final letter grade. Letter grade with minus and plus are also considered. Please refer to another file called “Grading Scale and Policy” on Blackboard for more details.

Course Schedule: A Weekly Breakdown

Readings and Homework: They will be posted on Blackboard on Thursdays, as lecture proceeds. Homework is due on Wednesdays by 2 pm. HW means homework.

Week, date	ISE 536 Weekly Topics Tentative Plan as of Jan 1, 2023	pre-recorded videos (min)	Text-book	Due
1, Jan 11	Introduction to the course, Review of linear algebra and Gauss-Jordan method, LP problem formulation		Chap: 2, 3	
2, Jan 18	Graphical solution versions, Elementary Row Operation, LP formulation skills	Linear equation (13), Graphical LP (17)	Chap: 3, 4	HW quiz
3, Jan 25	Simplex method versions, LP formulation skills, Motivation for sensitivity analysis, Introduction to AMPL	Simplex LP (25)	Chap: 3, 4	HW quiz
4, Feb 1	LP Sensitivity Analysis LP formulation skills	LP Sensitivity (61)	Chap: 3, 5	HW Quiz
5, Feb 8	LP sensitivity analysis LP formulation skills		Chap: 5, 6	HW Quiz AMPL
6, Feb 15	Midterm exam I (1.5 hour beginning of class) LP report writing			

Week	ISE 536 Weekly Topics Tentative Plan as of Jan 1, 2023	Pre-recorded video (min)	Text- book	Due Dates
7, Feb 22	LP Formulation skills Dual Problem of LP Goal Programming motivation	Dual LP (42)		quiz
8, Mar 1	Goal Programming (GP) formulation and sensitivity analysis	GP-1 (43), GP-2 (23)	Sec: 4.16	HW quiz
9, Mar 8	Goal Programming (GP) formulation and sensitivity analysis	FYI:GP Simplex (25)		HW
10, Mar 15	Spring break			
11, Mar 22	Integer Programming (ILP), Branch- and-Bound Method, LP formulation skill	ILP (39)	Sec: 9.3	HW quiz
12, Mar 29	Midterm exam II (1.5 hour beginning of class) Transportation Problem			
13, Apr 5	Transportation Problem and simplex transportation, Transportation Sensitivity Analysis	Transportation (43)	Chap: 7	quiz
14, Apr 12	Transshipment Problems	Transshipment (29)		HW quiz
15, Apr 19	Assignment Problems Travel Sales Person problem	TSP (33)	Chap: 7 Sec: 9.6	HW quiz
16, Apr 26	Review of the course and final exam			HW
Friday May 5	Final Exam, 2-4 pm			

You need to bring your computer with you to the class for quizzes and other activities.

ISE 536 COURSE SPECIFIC POLICIES

We all come from different backgrounds and hope for an excellent learning experience in a great learning environment. This section is to clear MY EXPECTATIONS and POLICIES for this course.

Intellectual property policies:

This is a clarification that any misuse, inappropriate dissemination, or attempted sale of class recordings and handouts, as well the appropriation of intellectual property is not acceptable. It is student's responsibilities towards the appropriate use and handling of these recordings under existing SCampus policies regarding class notes (<https://policy.usc.edu/scampus-part-c/>). Students are not permitted to create their own class recordings without the instructor's permission. Violations of these policies will be met with the appropriate disciplinary sanction.

Communication Policies

- Students are required to **use their USC email account** for any contact with instructor through email. It is required to include the course number (**ISE 536**) **in the subject** of the email. The instructor will reply to emails within 24 hours. It may take longer over weekends and holidays. The instructor does not respond to emails sent from non-USC accounts or email that does not have the course number on its subject.
- Instructor's office hours are open to all students and there is no need for prior appointment. However, if a student would like to have a private appointment, he/she can request it by sending an email. Provide several time windows that works for you so that I can select the one that works for me.
- Simple questions will be answered by email, but students may need to make an appointment for a meeting for more complex discussions or ask during the office hours.
- To promote independence and critical thinking, students are encouraged to try to find their answers by checking the video lectures on Blackboard, the posted handouts on Blackboard, and your textbook. If you do not find the answer you need, email the instructor and/or TA.

It is required to use your Cell Phone, laptop, and iPad during the class meetings ONLY for class related activities.

USC'S STATEMENT ON ACADEMIC CONDUCT AND SUPPORT SYSTEM

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu

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
usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776
dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs,

assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention - (213) 821-4710

campussupport.usc.edu

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101

diversity.usc.edu

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

dps.usc.edu, emergency.usc.edu

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) 442-120 – 24/7 on call

dps.usc.edu

Non-emergency assistance or information.