



Viterbi School of Engineering

As of Jan 2

ISE 536 Linear Programming and Extensions

Units: 3

spring 2022, Wed 3:00-5:50 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 D2L

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

Contact Info: parisay@usc.edu

Teaching Assistant: Vaishnavi Guntupalli

Office: online, Zoom link on the course's D2L

Office Hours: online, ????, and by appointment

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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. Quiz can be as multiple-choice or short written essay
Employ OR software (Software skill)	Assigned homework
Formulate several styles of LP problems (Formulation skill)	Math formulation in exam and project
Analyze software output (Analysis skill)	Essay in exam and project, in-class work
Detect extra information (Critical thinking)	Presenting extra higher-level information in exam and project, optional and self-developed extra credit
Compile a well-structured final report (Communication skill)	Essay in exam and project

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. There may be some pre-class work (activity) to enforce the learned material from the pre-recorded video.

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 in-class work 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 D2L 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** 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. There will be one midterm exam.
- **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** will be assigned each week on Thursdays. You will post your answer as a Word file on D2L before the next class by 12 noon on Wednesdays (unless otherwise indicated). Late homework and makeup homework will be considered under special situations with advance approval of instructor. Makeup HW may 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 2 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 seven homework randomly for grading. Each homework will have 2 points. The two lowest grades for homework will be dropped.
- **Project/Case study:** The project in this class is a team activity. I will assign the teams and the project in week 5. Some information in respect to your project will be posted on D2L later on. The purpose of the project is for you to utilize information you have learned during this class and to prepare a professional report. The project is delivered as one Word file per each team that is posted on D2L. There will be an initial report and a final report.
- **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 D2L. It will take about 10-15 min. It will require a few short answers or multiple choice. I will grade seven of the quizzes randomly. Makeup quiz will be considered under special situations with advance approval of instructor. Makeup quiz may 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 two lowest grades for quizzes will be dropped.

Grading Breakdown

Assignment	Points	% of Grade
Midterm exam	20	20
Final Exam	30	30
Project (initial and final report)	30	30
Homework	10	10
Quiz	10	10
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 D2L for more details.

Course Schedule: A Weekly Breakdown

Readings and Homework: They will be posted on D2L on Thursdays, as lecture proceeds. Homework is due on Wednesdays by 12 noon.

HW means homework.

Week, date	ISE 536 Weekly Topics Tentative Plan as of Jan 12, 2022	pre-recorded videos	Text-book	Due
1, Jan 12	Introduction to the course, Review of linear algebra and Gauss-Jordan method, LP problem formulation		Chap: 2, 3	
2, Jan 19	Graphical solution versions, Elementary Row Operation, LP formulation skills	Linear equation, Graphical LP	Chap: 3, 4	HW quiz
3, Jan 26	Simplex method versions, LP formulation skills, Motivation for sensitivity analysis	Simplex LP	Chap: 3	HW quiz
4, Feb 2	LP Sensitivity Analysis, LP formulation skills, Introduction to AMPL	LP Sensitivity	Chap: 3, 5	HW Quiz
5, Feb 9	LP sensitivity analysis		Chap: 5, 6	HW
6, Feb 16	Dual Problem of LP LP report writing	Dual LP	Chap: 6	HW quiz
7, Feb 23	LP sensitivity analysis LP Formulation skills	Software comparison		HW quiz
8, Mar 2	Review for midterm Formulation style			HW
9, Mar 9	Midterm online (1.5 hour beginning of class) Project BOR			

Week	ISE 536 Weekly Topics Tentative Plan as of Jan 12, 2022	Pre-recorded video	Text- book	Due Dates
10, Mar 16	Spring Break			
11, Mar 23	Goal Programming (GP) motivation Goal Programming (GP) formulation, Sensitivity Analysis and Report Writing	GP-1	Sec: 4.16	Initial Project Report
12, Mar 30	Goal Programming (GP) discussions, Integer Programming, Branch-and- Bound Method	GP-2, ILP	Sec: 9.3	HW quiz
13, Apr 6	Transportation Problem and simplex transportation, Transportation Sensitivity Analysis	Transportation, GP Simplex	Chap: 7	HW Quiz
14, Apr 13	Transshipment Problems	Transshipment	Chap: 7	HW quiz
15, Apr 20	Assignment Problems Travel Sales Person problem	TSP	Chap: 7 Sec: 9.6	HW quiz
16, Apr 27	Review of final exam			HW
Friday May 6	Final Exam, 2-4 pm			Final project report due at 10 am

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 as the appropriation of intellectual property is not acceptable. It is the 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 the 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 for more complex discussions students may need to make an appointment for meeting or ask during office hours.
- To promote independence and critical thinking, students are encouraged to try to find their answers by checking the video lectures on D2L, the posted handouts on D2L, and your textbook. If you do not find the answer you need, email the instructor.

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.