



Viterbi School of Engineering

As of Jan 16

ISE 536 Linear Programming and Extensions

Units: 3

Spring 2021, Mon, 6:40-9:20 pm

Location: online, using Desire to Learn (D2L)

Instructor: Dr. Parisay

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

Office: Online

Office Hours: online, Fri, 11-12 noon, and by appointment

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Teaching Assistant: Han Kyul (Hank) Kim

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IT Help: DEN@Viterbi / Technical Support Center

Hours of Service:

Contact Info: dentsc@usc.edu

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 By the end of this course, students should be able to:	Assignment/Assessment tools used This learning objective and skill is measured by:
Reproduce knowledge of several OR techniques (OR knowledge)	Quizzes at the beginning of synchronized live meeting (for lecture) based on 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, in-class work

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 D2L site. Each video will be around half-an-hour and will cover the basic knowledge about each topic. There will be handouts on D2L to accompany these pre-recorded video lectures. The course materials (handouts and video lectures) are on the course D2L site. There may be some pre-class work (activity) to enforce the learned material from the pre-recorded video.

We will use synchronized (live) meetings (sessions) for lectures on Mondays as well as the office hours on Fridays. The synchronized meetings will concentrate on more practice, answering common questions, and higher level of discussions. There will be in-class work during these meetings. Synchronized meetings will be recorded and posted for those who cannot attend these 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 documented emergencies, such as being hospitalized. There will be one midterm exam. A sample midterm exam will be added to the course's D2L site.
- **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 documented emergencies, such as being hospitalized. A sample final exam will be added to the course's D2L site.
- **Homework** will be assigned each week on Tuesdays. You will post your answer as a Word file on D2L before the next class by 5:30 pm on Mondays (unless otherwise indicated). No late homework will be accepted. No makeup homework will be considered. Homework is expected to be typed as much as possible and professionally done. Homework on average will take about 1.5 hour 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.
- **Participation activity:** In-class participation activity can happen any time during synchronized meeting for lecture on Mondays. There can be several participation activities in each meeting. The participation activity can be at different level of difficulty or different duration. I will grade some of these activities randomly. That is some activities can be graded for all students, or I ask only few students in regards to an activity and grade them. Each participation activity will have 2 points. The two lowest grades for participation activity will be dropped. The total points from these activities will be adjusted to make 10% of the final grade. These

activities will be graded based on knowledge and effort. Types of participation activities are:

- a) **Breakout room:** Students will be randomly assigned to different virtual rooms. Students in one room will first introduce themselves, then document their involvement in the Google Doc provided by TA. They discuss the question and collectively decide about the answer. Breakout room may take 10 to 20 minutes and will be announced at the beginning of the breakout room. I may grade the Google Docs for all Breakout rooms later on, or I may select a student randomly, when all return to the main room, to present the result from his/her Breakout room. Then, that individual will be graded. The Google Doc has a feature called ‘version history’ that can show the participation of each member in the room (in the form of your typed information). The version history will be the base for grade of each student if a Google Doc is graded. That is, the grade of students in one Breakout room is based on their participation in that Google Doc.
 - b) **Short essay question:** I will pose a question that its answer will be a short essay. A limited time (few minutes) will be allocated for your answer. I may select a student to share his/her answer in the main room and grade only that individual student. Or, I may ask all students to type their answer on a private Chat to TA or instructor.
 - c) **Multiple choice question:** a multiple-choice question will be posted on the screen and you write your selection on a private Chat to TA or instructor.
- **Quiz:** Quiz will be conducted at the beginning of scheduled synchronized meeting on Mon. 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 that you will type in a Word file. Then you will post your Word file on D2L. I will grade some of the quizzes randomly. Each quiz will have 3 points. The two lowest grades for quiz will be dropped. The total points from these quizzes will be adjusted to make 10% of the final grade.
 - **Students with asynchronous option (DEN):** Students who are as DEN students and cannot attend the synchronized meeting will have a makeup question in midterm and final exams to replace the ‘participation activity’ and ‘quiz’.

Grading Breakdown

Assignment	Points	% of Grade
Midterm exam	15	15
Final Exam	25	25
Homework	10	10
Case study (initial and final report)	30	30
Participation activity	10	10
Quiz	10	10

Total	100	100
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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 Tuesdays, as lecture proceeds. Homework is due on Mon by 5:30 pm.

HW means homework.

Week	ISE 536 Weekly Topics Tentative Plan	pre- recorded videos	Textbook	Due Dates
1, Jan 18	Holiday			
2, Jan 25	Introduction to the course, Review of linear algebra and Gauss-Jordan method, LP problem formulation		Chapters 2, 3	
3, Feb 1	LP versions, Graphical solution of LP, Simplex method, LP formulation skills, motivation for sensitivity analysis	Linear equation, Graphical LP	Chapters 3, 4	HW quiz
4, Feb 8	Application of software, LP Problem formulation skills	Simplex LP	Chapter 3	HW quiz
5, Feb 15	holiday			
6, Feb 22	LP Sensitivity Analysis Discussion on LP analysis and report writing Blending problem		Chapter 5	HW quiz
7, Mar 1	Review for midterm			HW quiz
8, Mar 8	Midterm online (1.5 hour beginning of class) Dual Problem of LP	Dual LP	Chapter 6	
9, Mar 15	Goal Programming (GP), Sensitivity Analysis and Report Writing	GP-1 GP-2	Section 4.16	Initial Project Report

Week	ISE 536 Weekly Topics Tentative Plan	Pre-recorded video	textbook	Due Dates
10, Mar 22	Goal Programming (GP), Integer Programming, Branch-and-Bound Method	ILP	Section 9.3	HW quiz
11, Mar 29	Transportation Problem and simplex transportation, Transportation Sensitivity Analysis	transportation	Chapter 7	HW Quiz
12, April 5	Transshipment Problems	Transshipment	Chapter 7	HW quiz
13, April 12	Assignment Problems Travel Sales Person problem		Chapter 7 Section 9.6	HW quiz
14, April 19	In-depth discussion on transshipment problems			HW quiz
15, April 26	Review of final exam			HW
16, May 10	Final Exam, 7-9 pm online			Final project report due at noon

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.

Netiquettes Policies

- Be respectful and considerate towards each other. Pay attention to the cultural and background differences.
- Synchronized live meetings will be recorded and posted on D2L later on.
- It is preferred that students attend the synchronized meetings based on university schedule of the class. If a student cannot attend the synchronized meeting, he/she need to email Instructor at the beginning of the semester.
- While in synchronized meetings, please make sure to show your complete first name and last name, as in the roster.
- While in synchronized meetings try to have your VIDEO ON. It assists in building a sense of community. However, Internet signal issues can happen which may result in turning off video in order to have a reasonable quality for audio.
- While in synchronized meeting be respectful to the LEARNING ENVIRONMENT such as: be attentive, have proper background, follow attires' norms as in on-ground classrooms, and be in a stationary location (i.e. not driving). Notice all of these are helpful to reduce distraction for others who are present.
- While in synchronized meeting, instructor will have everyone on MUTE to avoid unwanted background noises. You need to UNMUTE yourself when it is your turn to talk and then MUTE yourself when done.
- While in synchronized meeting, if you have question please type your question in the Chat feature. Instructor will stop at suitable points during discussion and will answer the questions. TA may be present at Chat and answer the questions there. I may call on you to answer a question during the synchronized meeting.
- While in Breakout rooms, try to be active, but do not dominate conversations, and limit non-relevant conversations.
- While using Chat, Discussion Forum, and email, be respectful and sensitive to background differences. Do not criticize and offend another person in public.
- Discussion Forum (Board) feature of the course can be used for questions that are not urgent. TA or instructor will check Discussion Forum once a week to provide answers. For urgent questions please send email to TA or instructor.
- Violations of these policies will be met with the appropriate disciplinary sanction such as requiring the student participate in asynchronized mode instead of synchronized ones. In such cases no makeup question will be given in exams for the missed participation and quiz.

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 (online) 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.
- 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.

Participation Activity Policies

There will be a variety of participation activity for students during synchronized meetings. Attendance will not be graded, instead participation will be graded. All class activities are open-note with a limited time. We will have some practices in class during the first week. Possible forms of participation activities are:

- Answering a question using Poll. This is anonymous and will not be graded. No cooperation with other students is permitted.
- Answering a multi-choice question. This may be graded. No cooperation with other students is permitted.
- Answering a question using Chat. Answers should be **sent ONLY to TA or instructor**. This may be graded. No cooperation with other students is permitted.
- Working in a small group on a question during Breakout room. No cooperation with other Breakout rooms is permitted.
- Members in Breakout rooms will be assigned randomly and is not optional. The members in a room may remain the same for more than one week.
- Participation activity may be assigned at any point during the class; students who miss the activity for any reason such as arriving late or leaving early will not have an opportunity to make up the activity.

Technology Policies

- You need to have access to a computer, the course D2L site (Desire to Learn). It is preferred to have access to a camera for class meetings. You can access class meetings **ONLY** from D2L.
- You need Word for your homework and exam.

- You need to use a software to solve the operations research problems. We will cover AMPL software. TA will provide you with related information. However, you can use any other related software. A software should be able to solve: linear programming, integer programming, goal programming, transportation, transshipment, and assignment problems.
- You may need to take a photo from your hand-written answers and paste it into a Word file. Alternatively, you may want to scan your answers and then paste it into a Word file.

Exam and Homework Policies

- All exams and homework should be individual work, unless otherwise mentioned. They are open source, but copy/paste from the sources are not acceptable. The answers should be in your own words. Collaboration with other students, copying another student's work, is not permitted and it is VOILATION OF ACADEMIC INTEGRITY. Violation of this requirement will lead to missing the whole points related to that exam or homework. For example, if even a part of one question in exam is similar to the one for another student the whole grade of that exam will be zero for both students. Software such as TurnItIn will be used for checking similarities.
- Word files to be submitted for exam and homework should be saved as '**lastname-firstname-subject**'. For example, if I am taking midterm exam, my related Word file for submission should be saved as 'Parisay-Sima-MidtermExam'. Another example, if I am submitting my homework for week 8, my related Word file for submission should be saved as 'Parisay-Sima-HW-week8'.
- There will be no make-up exam unless under emergency. Email the instructor as soon as possible to discuss alternate arrangements due to an emergency.
- It is expected to follow all deadlines, for homework and project. Late work will not be accepted unless due to an emergency situation excused by the instructor. Email the instructor as soon as possible to discuss alternate arrangements due to an emergency.
- Policies in relation to the team projects will be announced with project requirements later on.

Quiz Policies

This course will be conducted as a **Flipped Classroom**. There will be a pre-recorded video lecture each week that students have to watch and learn before the class, usually on Mondays. These videos will be accessible from the course D2L site. Each video will be less than half-an-hour and will cover the basic knowledge about each topic. There will be handouts on D2L to accompany these video lectures. Students can email TA and instructor with their questions after watching these videos.

- The scheduled synchronized meeting (class) will start with a quiz based on this pre-recorded video lecture. The quiz may take 10-15 minutes. Quizzes will have few questions that require short answers and/or multiple-choice questions. You need to have all your answers in a Word file and submit it on D2L.

- The Word file should be saved as ‘**lastname-firstname-quiz date**’. For example, if I am taking this quiz on September 21, I will save my Word file as ‘Parisay-Sima-Quiz-Sept21’.

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.