

# USC Viterbi School of Engineering

## ISE 536 Linear Programming and Extensions

Fall 2018, Mon and Wed, 6:30-7:50 pm

**Location:** KAP 156

**Instructor:** Dr. Parisay

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

**Office:** OHE 310U

**Office Hours:** Mon and Wed at 2:30-3 pm and 5-6 pm

**Contact Info:** [parisay@usc.edu](mailto:parisay@usc.edu)

**Teaching Assistant:** Siyuan Yao

**Office:** GER 242B

**Office Hours:** Mon 9-11 am

**Contact Info:** [siyuanya@usc.edu](mailto:siyuanya@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, analysis skills, and communication skills.

- Formulation skills for problems as a deterministic linear mathematical model (linear programming, goal (multi-objective) programming, integer programming, transportation, transshipment)
- Travel Sales Person (TSP) problems
- Simplex method for solving linear programming (LP)
- Dual of an LP and its application
- Extensive sensitivity analysis to answer “what if” questions (for all models)
- Application of software to solve the problems

**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

The course materials are in the Course Reader and the Blackboard.

## Technological Proficiency and Hardware/Software Required

You will use AMPL software for assignments and any software of your choice for project or case studies.

## Required Readings and Supplementary Materials

Required: Course Handouts (Included in Course Reader, course Blackboard, and in class) by Dr. Parisay. The Course Reader can be purchased from the USC Bookstore.

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 I** will be in-class based on the schedule, closed book, and 1.5 hours in length (will use part of the break time as well). Make up exam is only considered under documented emergencies, such as being hospitalized.
- **Midterm II** will be in-class based on the schedule, closed book, and 1.5 hours in length (will use part of the break time as well). Make up exam is only considered under documented emergencies, such as being hospitalized.
- **Final Examination** will be held at the completion of all classes based on the University schedule, closed book, and 2 hours in length. Make up exam is only considered under documented emergencies, such as being hospitalized.
- **Homework** are assigned each week on Fridays. You will submit your solution as a Word file to Blackboard before the next class on Wednesdays (unless otherwise indicated). No late homework will be accepted. No makeup homework will be considered. HW solution will be posted within few days after the due date. You need to refer to the posted solution as part of your next HW. HW is expected to be typed as much as possible and professionally done. A total of 8 HW will be assigned. Five HW will be randomly selected for grading. Grading is based on your effort (not the exact solution). The best three grades of HW will be used for the total points for HW.
- **Quiz/Participation** may be conducted at the beginning of a class or any time during the lecture. Only five quizzes will be randomly conducted and collected for grading. Quizzes are based on what was covered during the previous two sessions and the recent HW. No late quiz or makeup quiz will be considered. The best three grades of quizzes will be used for the total points for quiz.

- **Project/Case study:** The project in this class is a team activity. I will assign the teams after the Midterm I. Details will be posted 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 a hard copy report and the models on the last class session, as well as posted on Blackboard.

### Grading Breakdown

Assignment	Points	% of Grade
Mid-Term I	20	20
Mid-Term II	20	20
Final Examination	22	22
Homework (3 best out of 5)	9	9
Quizzes (3 best out of 5)	9	9
Case study (initial and final report)	20	20
<b>Total</b>	<b>100</b>	<b>100</b>

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 policy” on Blackboard for more details.

### Assignment Submission Policy

Assignments should be submitted to the Blackboard based on the schedule of the class. It should be professionally done. I may require hard copy as well for some assignments. No late assignment is accepted. No makeup quiz is considered. Makeup exam is considered only under documented emergencies.

### Additional Policies

**Cellular phones should be turned off in class. No texting in class.  
Computers can only be used for class related material.**

## Course Schedule: A Weekly Breakdown

**Readings and Homework:** They will be posted on Blackboard as lecture proceeds. Homework is due on Wed on Blackboard before 6 pm.

Week	ISE 536 Topics/Daily Activities Tentative (may change)	Readings and HW	Deliverable/ Due Dates
<b>1</b> Aug 20, 22	Introduction to the course, Review of linear algebra and Gauss-Jordan method, LP problem formulation, Graphical solution of LP, Simplex method	Chapters 2, 3, and 4	
<b>2</b> Aug 27, 29	LP Problem formulation skills, Application of software	Chapter 3	Aug 29 Homework
<b>3</b> Sept 5	Sept 3 is holiday.  LP Sensitivity Analysis	Chapter 5	Sept 5 Homework
<b>4</b> Sept 10, 12	LP Sensitivity Analysis, Report Writing	Chapter 5	Sept 12 Homework
<b>5</b> Sept 17, 19	Blending Problem, formulation skills		Sept 19 Homework
<b>6</b> Sept 24, 26	<b>Sept 26: Midterm I</b> (1.5 hour)  Dual Problem of LP	Chapter 6	
<b>7</b> Oct 1, 3	Economic Interpretation of Dual LP  Goal Programming (GP) Formulation	Section 4.16	
<b>8</b> Oct 8, 10	Goal Programming (GP) Formulation Goal Programming (GP) Sensitivity Analysis and Report Writing	Section 4.16	Oct 10 Homework
<b>9</b> Oct 15, 17	Goal Programming (GP) Sensitivity Analysis and Report Writing	Section 4.16	Oct 17 Homework
<b>10</b> Oct 22, 24	Integer Programming, Branch-and-Bound Method  Discussions on LP formulation skills	Section 9.3	Oct 24 Homework

<b>Week</b>	<b>ISE 536 Topics/Daily Activities Tentative (may change), Cont.</b>	<b>Readings and HW</b>	<b>Deliverable/ Due Dates</b>
<b>11</b> Oct 29, 31	Discussions on LP formulation skills <b>Oct 31: Midterm II</b> (1.5 hour)		
<b>12</b> Nov 5, 7	Transportation Problem and Sensitivity Analysis	Chapter 7	
<b>13</b> Nov 12, 14	Assignment and Transshipment Problems	Chapter 7	Nov 24 Homework
<b>14</b> Nov 19	Travel Sales Person problem Nov 21 is holiday.	Section 9.6	
<b>15</b> Nov 26, 28	Special cases in LP formulation		Nov 28 Final project report
<b>16</b> Dec 5	<b>Final Exam 7-9 pm</b>		

### **Statement for Students with Disabilities**

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Website and contact information for DSP:

[http://sait.usc.edu/academicssupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicssupport/centerprograms/dsp/home_index.html), (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) [ability@usc.edu](mailto:ability@usc.edu).

### **Statement on Academic Integrity**

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *SCampus*, the Student Guidebook, ([www.usc.edu/scampus](http://www.usc.edu/scampus) or <http://scampus.usc.edu>) contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

### **Emergency Preparedness/Course Continuity in a Crisis**

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard/D2L, teleconferencing, and other technologies.

## Statement on Academic Conduct and Support Systems

### 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](http://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, <http://policy.usc.edu/scientific-misconduct>.

### Support Systems:

*Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call*

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. [engemannshc.usc.edu/counseling](http://engemannshc.usc.edu/counseling)

*National Suicide Prevention Lifeline – 1 (800) 273-8255*

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. [www.suicidepreventionlifeline.org](http://www.suicidepreventionlifeline.org)

*Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call*

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. [engemannshc.usc.edu/rsvp](http://engemannshc.usc.edu/rsvp)

*Sexual Assault Resource Center*

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: [sarc.usc.edu](http://sarc.usc.edu)

*Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086*

Works with faculty, staff, visitors, applicants, and students around issues of protected class. [equity.usc.edu](http://equity.usc.edu)

*Bias Assessment Response and Support*

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. [studentaffairs.usc.edu/bias-assessment-response-support](http://studentaffairs.usc.edu/bias-assessment-response-support)

*The Office of Disability Services and Programs*

Provides certification for students with disabilities and helps arrange relevant accommodations. [dsp.usc.edu](http://dsp.usc.edu)

*Student Support and Advocacy – (213) 821-4710*

Assists students and families in resolving complex issues adversely affecting their success as a student  
EX: personal, financial, and academic. [studentaffairs.usc.edu/ssu](http://studentaffairs.usc.edu/ssu)

*Diversity at USC*

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. [diversity.usc.edu](http://diversity.usc.edu)

*USC Emergency Information*

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. [emergency.usc.edu](http://emergency.usc.edu)

*USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.*

Provides overall safety to USC community. [dps.usc.edu](http://dps.usc.edu)