USC Viterbi School of Engineering

ISE 536 Linear Programming and Extensions
Spring 2020, Mon, 6:40-9:20 pm
Location: OHE 100B

Instructor: Dr. Parisay
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 Office: OHE 310U
 Office Hours: Mon and Wed at 4:30-6 pm
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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 <u>deterministic linear mathematical model</u> (linear programming, goal (multi-objective) programming, integer programming, transportation, transshipment)
- Travel Sales Person (TSP) problems
- Simplex method for solving linear programming (LP)
- Transportation simplex method
- Dual of an LP and its application
- Extensive sensitivity analysis to answer "what if" questions (for all models) and report writing
- 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 on D2L.

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 D2L, and in class) 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 exams** will be in-class based on the schedule, closed book, and 1.5 hours in length. Make up exam is only considered under documented emergencies, such as being hospitalized. There will be two midterm exams.
- **Final exam** 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** will be assigned each week <u>on Tuesdays</u>. You will submit your answer as a Word file to D2L before the next class <u>on Mondays</u> (unless otherwise indicated). No late homework will be accepted. No makeup homework will be considered. HW is expected to be typed as much as possible and professionally done. A total of 9 HW will be assigned. All will be graded, each 1 point.
- **Project/Case study:** The project in this class is a team activity. I will assign the teams after the Midterm I. Some information in this respect 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 a hard copy report and the models on the last class session, as well as posting the Word file of the report on D2L.

Grading Breakdown

Assignment	Points	% of Grade
Midterm I exam	15	15
Midterm II exam	15	15
Final Exam	30	30
Homework	10	10
Case study (initial and final report)	30	30
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 policy" on D2L for more details.

Additional Policies

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

Please print lecture materials for each class session from D2L and bring to every class session.

Course Schedule: A Weekly Breakdown

Readings and Homework: They will be posted on D2L as lecture proceeds. Homework is due on Mon on D2L before 6 pm.

Week	ISE 536 Topics/Daily Activities Tentative (updated and may change)	Readings and HW	Deliverable/ Due Dates
1 Jan 13	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	
2 Jan 20	**Holiday**		
3 Jan 27	Application of software, LP Problem formulation skills	Chapter 3	Homework
4 Feb 3	LP Sensitivity Analysis	Chapter 5	Homework
5 Feb 10	Dual Problem of LP	Chapter 6	Homework
6 Feb 17	Economic Interpretation of Dual LP Review for midterm	Chapter 6	Homework
7 Feb 24	**Midterm I** (1.5 hour) Goal Programming (GP)	Section 4.16	
8 Mar 2	Goal Programming (GP) Sensitivity Analysis and Report Writing	Section 4.16	Homework
9 Mar 9	Integer Programming, Branch-and-Bound Method Transportation Problem and simplex transportation	Section 9.3 Chapter 7	Homework
10 Mar 16	**Spring break**		

Week	ISE 536 Topics/Daily Activities Tentative (may change), Cont.	Readings and HW	Deliverable/ Due Dates
11 Mar 23	Transportation Sensitivity Analysis Review for midterm	Chapter 7	Initial Project Report
12 Mar 30	**Midterm II** (1.5 hour) Assignment and Transshipment Problems	Chapter 7	
13 Apr 6	Travel Sales Person problem	Section 9.6	Homework
14 Apr 13	Discussion on LP analysis and report writing		Homework
15 Apr 20	Discussion on LP analysis and report writing		Homework
16 Apr 27	Special cases in LP formulation Review of final exam		Final project report
17 May 4	Study break		
18 May 11	**Final Exam 7-9 pm location will be announced**		

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/academicsupport/centerprograms/dsp/home_index.html, (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) 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 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 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. 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

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

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

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

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

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

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations.
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/ssa

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

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

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