ISE 530 Optimization for Analytics
Fall 2017, Thursday 02:00–04:50 PM; KAP 148

Instructor	Jong-Shi Pang
Coordinates	Office: Olin Hall 310C; *email*: `jongship@usc.edu`
Office Hour	Thursday 10:30–11:45 AM and by appointment
Teaching Assistant	
Office Hour	
Required textbook	Gerard Cornuejols and Reha Tütüncü. *Optimization Methods in Finance*. Fourth Printing. ISBN-13: 978-0-521-86170-0; Cambridge University Press (2013)
Recommended book	Trevor Hastie, Robert Tibshirani, and Martin Wainwright. *Statistical Learning with Sparsity*. CRC Press (2015)
Modeling language text	Robert Fourer, David M. Gay, and Brian W. Kernighan *AMPL: A Modeling Language for Mathematical Programming* Second edition, ISBN 0-534-38809-4 (available online and downloadable from: `http://www.ampl.com/`)
Software tools	• Familiarize yourself with the NEOS server for optimization `https://neos-server.org/neos/` • Learn MATLAB and be able to write programs using it for matrix computations
Workload	• Roughly ten to twelve homework sets for the semester • Under no circumstance will late homework be accepted • The worst two homework sets will be excluded in calculating the final homework grade **Start your homework assignment early**
Expectations	Similar homework papers will be examined carefully for sign of plagiarism Penalty will be imposed if there is evidence of academic integrity violation
Examinations	Two in-class 120-minutes examinations
Grade Distribution	Homework 25%; each exam 35%; remaining 5% to be determined (class attendance + others)

Goals. Taught at a fast-paced masters level, this course covers classes of optimization problems, a touch of their theory, and basic methods for their numerical solutions. The topis provide a set of fundamental tools for the understanding and solution of a variety of data-analytic problems including those arising from operations, statistics, machine learning, financial engineering, network science, and data-driven modeling.

A word about pre-requisites. This course makes heavy use of linear algebra and matrix operations and assumes that you are comfortable with college-level mathematical reasonings typical of an engineering curriculum. If you are not comfortable with these pre-requisites, either quickly review the materials or postpone taking the course until you are ready.

Tentative Schedule: Most of the lectures are based on the two texts; additional materials are drawn from other sources.

- LINEAR PROGRAMMING (3 1/2 weeks)
— modeling (selected models and as a modeling tool)
— simplex method and modeling language (AMPL)
— duality theory and sensitivity analysis
— network flow problems (transportation/assignment/transhipment)

- QUADRATIC PROGRAMMING (3 1/2 weeks)
— applied models (least-squares regression, portfolio selection, support vector machines)
— the LASSO ESTIMATOR and extensions
— a touch of theory
— numerical methods: feasible direction and coordinate descent

Review session: Tuesday October 10; time and place TBD

Thursday October 12, 02:00–04:00 PM In-class 2-hour examination

- NONLINEAR PROGRAMMING (3 weeks)
— applied models (logistics regression/classification)
— unconstrained problems
— convex optimization
— inequality constraints
— basic numerical methods

- INTEGER PROGRAMMING (3 weeks)
— selected problem classes (knapsack, set covering/partition/packing, fixed costs, logical relations)
— basic branch and bound and cutting planes methods
— Lagrangian relaxation
— portfolio revision
— sparsity minimization

- STOCHASTIC PROGRAMMING (1 week)
— expected-value and two-stage problems
— value-at-risk and conditional value-at-risk
— quantile optimization

Thursday December 07, 02:00–04:00 PM In-class 2-hour examination

University policies

• *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 your course instructor (or TA) as early in the semester as possible. DSP is located in STU 301 and is open from 8:30am to 5:00pm, 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 ones own academic work from misuse by others as well as to avoid using anothers work as ones own. All students are expected to understand and abide by these principles. SCampus, The Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: `http://usc.edu/dept/publications/SCAMPUS/gov/`. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review should there be any suspicion of academic dishonesty. The Review process can be found at: `http://usc.edu/student-affaris/SJACS/`. Information on intellectual property at USC is available at: `http://usc.edu/academe/acsen/issues/ipr/index.html`.

• *Emergency Preparedness/Course Continuity in a Crisis.* In case of emergency, when travel to campus is difficult, if not impossible, USC executive leadership will announce a digital way for instructors to teach students in their residence halls or homes using a combination of the Blackboard LMS (Learning Management System), teleconferencing, and other technologies. Instructors should be prepared to assign students a "Plan B" project that can be completed "at a distance". For additional information about maintaining your classes in an emergency, please access: `http://cst.usc.edu/services/emergencyprep.html`.