

Stochastic Optimization ORI 391Q.10 Fall Semester 2008

Instructor: David Morton

Time and location: Tuesdays and Thursdays, 12:30-2pm, ETC 4.150

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E-mail: morton@mail.utexas.edu

Web site: Blackboard

Computer facilities: Obtain an account at: <http://hpc.me.utexas.edu/>

Prerequisites: Knowledge of linear programming, probability and statistics.

Text: J.R. Birge and F. Louveaux, *Introduction to Stochastic Programming*, Springer-Verlag, New York, 1997.

Software: A. Brooke, D. Kendrick, A. Meeraus and R. Raman *GAMS: A User's Guide*
Can be downloaded from: <http://www.gams.com/docs/document.htm>

Grading Policy

Problem Sets	30%
In-Semester Exam	40%
Project	30%

Late problem sets will not be accepted.

Course Outline

- **Modeling and Applications**
 - Extending the linear programming model
 - Feasibility: fat, penalty, and chance-constrained models
 - Optimality: expected-value, probability threshold, Markowitz, and expected utility
 - Stochastic programming with recourse
 - Some applications
 - Capacity expansion planning (power systems and telecommunications),
 - Financial planning, Vehicle allocation, Hydroelectric scheduling
 - Capacitated facility location, Network interdiction / design
 - Bounds on the value of information and the value of the stochastic solution
- **“Exact” Optimization Methods**
 - Extensive forms
 - L-shaped method
 - Enhancements: multicut, proximal term, bunching, preliminary cuts
 - Extensions to multistage setting
- **Deterministic Approximation and Bounding Techniques**
 - Jensen and Edmundson-Madansky bounds
 - Bounds for network recourse problems
 - Stochastic PERT, max-flow, telecommunications, vehicle allocation
 - Sequential approximation methods
- **Monte Carlo Sampling-Based Approximations**
 - Internal and external approximations
 - Consistency
 - Rates of convergence
 - Solution validation
 - Sequential issues
- **Additional Topics**
 - Robust optimization
 - Infinitesimal Perturbation Analysis
 - Software

References

- Stochastic Programming Community Home Page: <http://stoprog.org>
- M. Dempster (ed.), *Stochastic Programming*, Academic Press, London, 1980.
- J. Dupačová, J. Hurt and J. Štěpán. *Stochastic Modeling in Economics and Finance*, Kluwer Academic Publishers, 2002.
- Y. Ermoliev and R.J.-B. Wets (eds.), *Numerical Techniques for Stochastic Optimization*, Springer Verlag, Berlin, 1988.
- K. Frauendorfer, *Stochastic Two-Stage Programming*, Springer Verlag, Berlin, 1992.
- W.K.K. Haneveld, *Duality in Stochastic Linear and Dynamic Programming*, Springer Verlag, Berlin, 1986.
- J.L. Higle and S. Sen, *Stochastic Decomposition: A Statistical Method for Large Scale Stochastic Linear Programming*, Kluwer Academic Publishers, Dordrecht, 1996.
- G. Infanger, *Planning Under Uncertainty: Solving Large-Scale Stochastic Linear Programs*, The Scientific Press Series, Boyd & Fraser, 1993.
- P. Kall and S.W. Wallace, *Stochastic Programming*, John Wiley & Sons, Chichester, 1994. (This book is available for free download. See <http://stoprog.org>)
- J. Mayer, *Stochastic Linear Programming Algorithms: A Comparison Based on a Model Management System*, Gordon and Breach Science Publishers, Amsterdam, 1998.
- G. Ch. Pflug, *Optimization of Stochastic Models: The Interface Between Simulation and Optimization*, Kluwer Academic Publishers, Boston, 1996.
- A. Prékopa, *Stochastic Programming*, Kluwer Academic Publishers, Dordrecht, 1995.
- R.T. Rockafellar and R.J.-B. Wets, *Variational Analysis*, Springer-Verlag, Berlin, 1998.
- R.Y. Rubinstein and A. Shapiro, *Discrete Event Systems: Sensitivity Analysis and Stochastic Optimization by the Score Function Method*, John Wiley & Sons, Chichester, 1993.
- A. Ruszczyński and A. Shapiro (eds.), *Stochastic Programming*, Handbooks in Operations Research and Management Science, Elsevier, Amsterdam, 2003.

Additional Administrative Notes

The University of Texas at Austin provides upon request appropriate academic adjustments for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4241 TTY or the College of Engineering Director of Students with Disabilities at 471-4382.

An engineering student must have the dean's approval to add or drop a course after the fourth class day of the semester or after the second class day of a summer term. Adds and drops are not approved after the fourth class day except for good cause. "Good cause" is interpreted to be documented evidence of an extenuating nonacademic circumstance (such as health or personal problems) that did not exist on or before the fourth class day.

A Course-Instructor Survey from UT's Measurement and Evaluation Center will be administered near the end of the semester.