

SIE 649 STOCHASTIC OPTIMIZATION

Fall 2026

Class Meeting Times & Location:

T Th 12:30pm – 1:45pm

Instructor: Prof. Pavlo Krokhmal

Office: ENGR 223

Tel: (520) 621-2605

E-mail: krokhmal@arizona.edu

Office hours: for appointments, contact the instructor by email

Course Description: Stochastic Optimization is an introductory course for graduate students in engineering, operations research, management, etc. The objective of the course is to familiarize students with the challenges that uncertain or randomized data bring into decision making/design process and introduce the general methods and approaches for dealing with such challenges. We will discuss various approaches to modeling of uncertainties and risk in optimization problems, properties of the resulting stochastic programming formulations, and several common techniques for solving stochastic programs.

Course Topics:

- Applications and examples
- Modeling of uncertainties in optimization problems (decisions and stages, two-stage and multi-stage programs, probabilistic programming, risk-averse optimization, etc.)
- Basic theory and properties of two-stage and multi-stage stochastic problems
- Solution methods (L-shaped method, stochastic quasi-gradient methods, etc.)
- Modeling with AMPL and Julia

Required Text: None

Recommended Texts:

John R. Birge, François Louveaux, *Introduction to Stochastic Programming*, 2nd Edition, ISBN-10: 1461402360

Prekopa, A. *Stochastic Programming*, ISBN: 978-94-017-3087-7

Shapiro, A., Dentcheva, D., and A. Ruszczyński. *Lectures on Stochastic Programming: Modeling and Theory*, ISBN: 978-0-898716-87-0

[Kall, P. and S. Wallace \(1994\) *Stochastic Programming*, 2nd Edition. Wiley & Sons, Chichester](#) (the publisher reverted the rights to the authors on February 4, 2003.

Prerequisites: Courses in probability and linear programming/operations research

Assignments: 50% Homework, 50% Project

Grading:

- A: 90 – 100%
- B: 80 – 89%
- C: 70 – 79%
- D: 60 – 69%
- E: 0 – 59%

Projects: Class projects are expected to be done in small groups (usually 2, no more than 3 students). Students are expected to identify a suitable topic, conduct problem modeling/formulation, data collection/analysis, numerical experiments, and analysis of the solution. It is expected that students start working on the project about midway into the semester. At the end of the semester, student groups will have to present their project in 15-20 minutes talks, as well as submit a project report. Both the project presentation and project report factor into the final grade.

Equipment and software requirements: For this class students will need daily access to a laptop or web-enabled device with webcam and microphone; regular access to broadband internet connection; ability to download and run software for computations and optimization, such as AMPL, Julia, Python, CVX/Matlab, etc. For projects, a sufficiently powerful laptop or desktop may be needed.

Attendance Policy: Students are expected to attend class. If you miss a class meeting, you are responsible for watching the class recording, obtaining the class notes, assignments, and announcements. Phone usage is not allowed during the class meetings; please put your phone into “quiet”, or “vibrate” mode prior to start of the class.

Accommodation for Students with Special Needs: Students with disabilities or special needs for accommodations (including in-class meetings and exams) are required to contact both the instructor and the S.A.L.T. Center (www.salt.arizona.edu) or the Disability Resource Center (<http://drc.arizona.edu>) as early as possible in the semester. They are also required to submit appropriate documentations to the instructor before accommodations could be offered.

Academic Honesty: All students are expected to commit themselves to be honest in all academic work and understand that failure to comply with this commitment will result in disciplinary action. This is a reminder to uphold your obligation as a UA student and to be honest in all work submitted and exams taken in this course and all others.

Generative AI use is NOT allowed: In this course any and all uses of generative artificial intelligence (AI)/large language model (LLM) tools and platforms, such as ChatGPT, Dall-e, Claude, Gemini, Grok, DeepSeek, Copilot, etc., will be considered a violation of the Code of Academic Integrity, specifically the prohibition against submitting work that is not your own. This applies to all assessments in the course. Examples of prohibited generative AI uses include, but are not limited to:

- Entering all or any part of an assignment statement or question as part of a prompt into an AI/LLM tool
- Incorporating any part of an AI-written response in an assignment
- Using AI to summarize or contextualize reading assignments or source materials
- Submitting your own work for this class to a large language model AI tool for iteration or improvement

This syllabus is tentative and the instructor reserves the right to make modifications if appropriate.