OPER 791 Optimization under Uncertainty MW 2:00 - 3:15 PM, Harris Hall 4155

Instructor: Yongjia Song, Office: Harris Hall 4140, Email: ysong3@vcu.edu

Office Hours: 3:00-4:00 PM TT, and by appointment.

Textbook: Introduction to Stochastic Programming, 2nd edition, by J. Birge and F. Louveaux

Other reference:

(a) Lectures on Stochastic Programming, by A. Shapiro, D. Dentcheva and A. Ruszczynski. Available at `http://www2.isye.gatech.edu/people/faculty/Alex_Shapiro/SPbook.pdf` (very theoretical, requires very advanced math background).

(b) Stochastic Programming, 2nd edition, by P. Kall and S. Wallace. Available online at: `http://www.csee.wvu.edu/~xinl/library/books/stochastic_programming.pdf`

Course Objectives and Prerequisite: This course will address basic models and algorithms for stochastic programming (optimization). Stochastic programming is a popular optimization tool that integrates statistics and operations research. Students are expected to have certain math background: basic calculus, basic linear algebra, and some mathematical analysis ability. Basic knowledge in optimization: linear programming, mathematical modeling. Basic knowledge in statistics: basic probability, statistical tests. Basic knowledge in a general purpose programming language is preferred, but not required. After the course, students are expected to understand and apply stochastic optimization tools:

- How to create a stochastic programming model using the given information (data, probability distribution, decision makers' risk tolerance, etc)
- How to solve the stochastic programming model using certain optimization solvers
- How to perform statistical analysis on the solutions of stochastic programs

Course Topics:

- Part 1: Modeling uncertainty in optimization
- Part 2: Solution methods
  - Two-stage stochastic programs with recourse
  - Multi-stage stochastic programs
  - Risk averse and chance-constrained programs
- Part 3: Sampling methods in stochastic programs
- Part 4: Other models for optimization under uncertainty
  - Robust optimization
  - Markov decision process

Grading Policy The grade is distributed into the following sections:

- Homework: 30%
- Mid-term: 30%
- Course Project: 30%
- Participation: 10%

Mid-term exam focuses on the first two parts of the course material. No makeup exams will be given unless a university-approved excuse is provided. When possible, excuses should be provided at least ten days prior to the exam. Students will work in groups on the selected course projects. Project presentations will be arranged in the last one or two weeks of class. Project reports will be due on the last day of the final week.

The tentative grading scale:

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

Assignments: This course has approximately five or six assignments in total. Some of them require a minimum amount of coding in a basic modeling language.

- All assignments are due when class begins on the assigned due date.
- You have FIVE "free" days for delayed assignment submission. After that, 20% of the grade will be taken off for each day delayed.
- No assignments will be accepted if more than five days overdue.
- You are welcome to submit an electronic version of your homework through Blackboard (`https://blackboard.vcu.edu`). All coding assignments will be submitted through Blackboard.

VCU Statement on Safety What to know and do to be prepared for emergencies at VCU:

- Sign up to receive VCU text messaging alerts (www.vcu.edu/alert/notify). Keep your information up-to-date.
- Know the safe evacuation route from each of your classrooms. Emergency evacuation routes are posted in on-campus classrooms.
- Listen for and follow instructions from VCU or other designated authorities.
- Know where to go for additional emergency information (www.vcu.edu/alert).
- Know the emergency phone number for the VCU Police (828-1234). Report suspicious activities and objects.

VCU Honor System All VCU students are presumed upon enrollment to have acquainted themselves with and have an understanding of the Honor System. Therefore, it is a student's responsibility to ask course instructors to clarify expectations for each assignment in order to be in compliance with the Honor System. The VCU Honor System policy statement and purpose is located at `http://www.provost.vcu.edu/pdfs/Honor_system_policy.pdf`

Statement on Americans with Disabilities Act Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 require Virginia Commonwealth University to provide an 'academic adjustment' and/or a 'reasonable accommodation' to any individual who advises us of a physical or mental disability. If you have a physical or mental limitation that requires an academic adjustment or an accommodation, please arrange a meeting with me at your earliest convenience. Additionally, if your course work requires you to work in a lab environment, you should advise the instructor or department chairperson of any concerns you may have regarding safety issues related to your limitation(s).

This syllabus is subject to change at any time at the discretion of the instructor.