MEETINGS
Thursday, 6pm-9pm
Classroom: TBD

INSTRUCTOR
Professor Jiawei Zhang
Office: KMC 8-66
Phone: (212) 998-0811
E-mail: jzhang@stern.nyu.edu

OFFICE HOURS
Thursday 5PM-6PM or by appointment.

COURSE DESCRIPTION
This course introduces the basic concepts, principles, and techniques of decision making under uncertainty. You will learn how to model complex business problems that involve risk and uncertainty with the help of spreadsheet models. The course covers analytical models such as Decision Tree, Stochastic Optimization, Simulation & Optimization, and Dynamic Optimization. The course is hands-on. The emphasis will be on model formulation and interpretation of results, not on mathematical theory.

This course does NOT require the course “Decision Models and Analytics” (DMA) as a prerequisite. This course emphasizes optimization models with uncertain parameter values. In contrast, the DMA course focuses on various deterministic optimization models and Monte Carlo simulation. You are encouraged to take both courses.

Examples covered in this course come from a wide range of business applications, including:
- Financial and operational hedging strategies for risk management (currency exchange rate, stock price, etc.)
- Option pricing (European options, American options)
- Real option approach to the valuation of investment opportunities
- Capacity planning for new product development (drugs, cell phones, etc.)
- Optimal timing for market entry
- Choosing a portfolio of supply contracts that balance risk and cost
- Inventory management with random demand
LEARNING OBJECTIVES

From this course, students will

- Become aware of the scope of management problems that can be addressed with stochastic optimization models; and learn to identify opportunities for creating value using these models;
- Develop models that can be used to improve decision making under uncertainty within an organization;
- Sharpen their ability to structure problems and to perform logical analyses;
- Know how to assess the significance of model outputs for managerial insights and action;

PREREQUISITES

- COR1-GB.1305 Statistics and Data Analysis
- Basic familiarity with Microsoft Excel: developing and copying formulas with relative and absolute cell addresses, and using the function and chart wizards.

RECOMMENDED TEXTBOOKS

The following books are very good references for this course. They are **recommended, not required**.


WEBSITE/COURSE MATERIALS

Material, including Excel solution models, software, optional readings and lecture slides, will be distributed electronically through the course web site (NYU Classes). Hard copies of lecture slides will be distributed in class.

GRADING

Your course grade will be based on:

- **Group Assignments** (80% - four assignments: 20% each). There will be four graded group assignment studies, with the due dates indicated in the course schedule. You are asked to work in groups of three people. One copy of the final report should be handed in, and all members of the group will get the same grade.
- **Class Participation** (20%). This fraction of the grade will be assigned on the basis of class participation and individual professional conduct. Class participation includes class discussions of assignments and cases, presentation of an exercise solution, as well as active participation in lectures. I expect all class participants to arrive to class on-time and prepared, and to stay involved during class sessions. Every conceivable effort should be made to avoid absences, late arrivals or early departures. In cases when these are unavoidable, they need to be communicated to me in advance.
CLASS WORK

The process of modeling is the most important and difficult problem solving skill. It involves developing a structure to conceptualize, formalize and analyze a given problem. It seems deceptively simple to watch someone else do it, but the only way to learn this skill is by practicing it yourself. Therefore, this course involves a hand-on, in-class learning experience. **Attending each class and bringing a laptop computer to class are essential.** Preparation for each class involves reading and thinking about the problems to be covered in class. The problems will be posted on Blackboard one week in advance. Excel files of the problems modeled and analyzed in class should be downloaded from Blackboard before (not during) the class.

Classroom Norms

Cell phones, Smartphones and other electronic devices are a disturbance to both students and professors. All electronic devices (except laptops) must be turned off prior to the start of each class meeting.

Laptops

You are expected to bring a laptop to each class, unless otherwise instructed. But we will not use it throughout each class. Please close your laptop until you are asked to use it.

Ethical Guidelines

All students are expected to follow the **Stern Code of Conduct** ([http://www.stern.nyu.edu/uc/codeofconduct](http://www.stern.nyu.edu/uc/codeofconduct)). A student’s responsibilities include, but are not limited to, the following:

- A duty to acknowledge the work and efforts of others when submitting work as one’s own. Ideas, data, direct quotations, paraphrasing, creative expression, or any other incorporation of the work of others must be clearly referenced.
- A duty to exercise the utmost integrity when preparing for and completing examinations, including an obligation to report any observed violations.

Students with Disabilities

If you have a qualified disability and will require academic accommodation during this course, please contact the Moses Center for Students with Disabilities (CSD, 998-4980) and provide me with a letter from them verifying your registration and outlining the accommodations they recommend.
Tentative Class Schedule
(subject to minor changes)

• Sessions 1 & 2: Simple Static Stochastic Optimization Models
  - Using data to model currency exchange rates, stock prices, commodity prices, air travel demand
  - Brief introduction to Monte Carlo simulation
  - Optimal financial hedging strategies
  - Supply contract selection
  - Airline booking control

• Session 3: Sequential Decision Making: Decision Tree
  - Introduction to decision tree
  - Value of information
  - Bayesian update

• Session 4: Real Options and Decision Tree
  - Value an R&D project: managing technology risk
  - Value a license agreement
  - Options to postpone, expand, and contract

• Session 5: Sequential Decision Making: Stochastic Dynamic Programming
  - Introduction to dynamic programming
  - Binomial tree
  - American option pricing
  - Targeted marketing

• Session 6: Sequential Decision Making: Implementing Simple Policies
  - Inventory management at a retail pharmacy
  - Optimal timing for market entry
  - Cash management at a retail bank

• Session 7: Forecasting Methods
  - Moving average
  - Trends
  - Seasonality

• Session 8: Re-optimization
  - Introduction to linear programming
  - Production planning with forecasted demand
  - Airline revenue management

• Session 9: Chance-Constrained Stochastic Optimization
  - Capital budgeting: when projects have uncertain NPVs and uncertain capital usage
  - Production strategy: managing quality risk of raw materials
  - Value-at-risk
• Session 10: Combing Simulation with Linear Optimization
  - Plant location for a multinational firm: hedging currency exchange risk
  - Process flexibility: hedging demand risk

• Session 11: Two-Stage Stochastic Optimization with Recourse
  - Inventory transshipment: managing demand risk
  - Capacity planning for an electric utility

• Session 12: TBD