



**COURSE SYLLABUS:
ADVANCED DECISION MODELS**
OPMG-GB.2351.30 (B60.2351.30)
(subject to minor changes)

MEETINGS: Wednesday, 6pm-9pm, Feb 8th – May 2nd, Tisch-UC25

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

OFFICE HOURS: Wednesday 5pm-6pm or by appointment

GRADER:

COURSE DESCRIPTION

This course is designed for students who have taken Decision Models (B60.2350) and would like develop further their quantitative modeling skills for managerial decision making. Students will learn more advanced modeling tools including: static stochastic optimization, two-stage stochastic optimization with recourse, chance-constrained stochastic optimization, and dynamic programming. We explore their applications in various business domains, such as marketing, finance, inventory management, revenue management, supply chain management, project management, among others. Students will learn how these models can be solved using Risk Solver Platform for Excel, a powerful tool for risk analysis, simulation, and optimization. The emphasis throughout the course will be model formulation, solution methods, and managerial interpretation of the results, rather than on the mathematical algorithms used to solve models.

LEARNING OBJECTIVES

From this course, you should be able to

- Recognize the types of modeling tools most adapted to a given situation;
- Understand their main benefits and limitations
- Structure real life managerial problems, build and analyze models to address the problems
- Identify opportunities for benefiting from use of the models

PREREQUISITES

B60.2350: Decision Models or
C70.0007: Decision Models

RECOMMENDED TEXTBOOKS

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

- *Decision Making Under Uncertainty with RISKOptimizer* (2nd edition), by Wayne Winston.
- *Financial Models Using Simulation and Optimization II* (3rd edition), by Wayne Winston

WEBSITE/COURSE MATERIALS

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

GRADING

Your course grade will be based on:

- *Group Assignments* (75% - three assignments: 25% each). There will be three 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* (25%). 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. 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>). 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](tel:998-4980)) and provide me with a letter from them verifying your registration and outlining the accommodations they recommend.

TOPICS

Topic 1: Real Option Approach to the Valuation of Investment Opportunities: Simulation

- Valuing an R&D Project
- Valuing Options to Postpone, Expand, and Contract
- Value an Option to Develop Vacant Land
- Value a Licensing Agreement
- Valuing an Internet Start-up
- Valuing a “Pioneer Option”

Topic 2: Stochastic Optimization Models

- [Optimal Sampling Plan in Quality Management](#)
- [Audit Sampling](#)
- [Truck Loading with Uncertain Demands](#)
- [Inventory Model for Substitutable Products](#)
- [The Miller-Orr Cash Management Model](#)
- Retirement Planning: Long Term Growth of Investment and Kelly’s Rule
- Optimal Hedging of Investment
- Hedging Foreign Exchange Risk
- Hedging Commodity Risk When Production is Correlated with Price
- Hedging a Minor Currency with a Related Currency
- Hedging with Futures

Topic 3: Stochastic Optimization with Chance Constraints and (Conditional) Value at Risk

- [Animal Feed Formulation at Agway](#)
- [Production Scheduling with Stochastic Demand](#)
- [Manpower Scheduling Under Uncertainty](#)
- [Improving Team Productivity at the Federal Reserve Bank](#)
- Portfolio Optimization, CVaR, One-Fund Theorem
- Capital Budgeting with Uncertain Resource Usage

Topic 4: Two-Stage Stochastic Optimization with Recourse

- [Pricing and Advertising](#)
- [Determine Optimal Plant Capacities and Distribution Plan](#)
- [Agricultural Planning under Uncertainty](#)
- [Modeling Process Flexibility](#)
- [Capacity Planning for an Electric Utility](#)
- [Capacity Allocation in Airline Revenue Management](#)
- Cash Matching

Topic 5: Deterministic Dynamic Programming

- Production Planning
- Resource Allocation
- Machine Replacement
- Knapsack Problem and Investment Model

Topic 6: Stochastic Dynamic Programming

- Targeted Marketing
- Optimal Mining Strategy: Expansion Option, and Startup and Shutdown Option
- Multi-period Inventory Management with Random Demand
- Pricing American Options and Binomial Lattice
- Valuing an Option to Purchase with an Abandonment Option

Topic 7: Structure of Optimal Policies in Stochastic Optimization

- Optimal Ordering Policies and Demand Forecasting for Fashion Goods
- Optimal Select of Employees
- Optimal Capacity and Demand Simulation for a New Product
- Test-Marketing a New Product
- Time Market Entry