SYLLABUS
DECISION MODELS AND ANALYTICS

OPMG-GB.2350.W1

MEETINGS

January 8th – 27th: Monday/Wednesday, 6pm-9pm; Saturday 9am-4pm

M 01/08	06:00pm - 09:00pm
W 01/10	06:00pm - 09:00pm
S 01/13	09:00am - 04:00pm
M 01/15	06:00pm - 09:00pm
W 01/17	06:00pm - 09:00pm
S 01/20	09:00am - 04:00pm
M 01/22	06:00pm - 09:00pm
W 01/24	06:00pm - 09:00pm
S 01/27	09:00am - 04:00pm

Classroom TBD

INSTRUCTOR

Professor Jiawei Zhang
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Webpage : http://www.stern.nyu.edu/faculty/bio/jiawei-zhang/339

OFFICE HOURS

Wednesday 5PM-6PM or by appointment.

GRADER

COURSE DESCRIPTION

This course introduces the basic concepts, principles, and techniques of decision modeling and analytics. In the first part of the course, we focus on the use of **optimization** to support decision-making in the presence of a large number of alternatives and business constraints. In the second part, we focus on the use of **Monte Carlo simulation** in valuing and managing complex portfolios of risks.

The course is entirely **hands-on**. You will learn how to apply analytics to a wide array of business decision problems with the help of **spreadsheet models**. The topics covered in this course come from a wide range of business applications, including:

- **Finance** (portfolio optimization, risk management, project valuation, financial planning, capital budgeting, retirement planning, option pricing)
- **Marketing** (media selection, online advertising, customer lifetime value, test market, pricing)
- **Operations** (inventory management, production planning, supply chain management, staff planning and scheduling, project management)
- **Revenue Management**

The emphasis will be on model formulation and interpretation of results, not on mathematical theory.

LEARNING OBJECTIVES

From this course, students will

- Become aware of the scope of management problems that can be addressed with decision models; and learn to identify opportunities for creating value using decision models;
- Develop models that can be used to improve decision making within an organization;
- Sharpen their ability to structure problems and to perform logical analyses;
- Practice translating descriptions of decision problems into formal models, and investigate those models in an organized fashion;
- Recognize the types of modeling tools most adapted to a given situation;
- Know how to assess the significance of model outputs for managerial insights and action;
- Strengthen their computer skills, focusing on how to use the computer to support decision-making.

PREREQUISITES

Since the course relies on spreadsheets as a platform for model building, basic familiarity with Microsoft Excel is assumed. These include developing and copying formulas with relative and absolute cell addresses, and using the function and chart wizards. We will augment Excel with add-ins for the different modules of the course. In each case, full instructions regarding software access and use will be provided at the opportune time.

Knowledge of basic statistics (mean, variance, probability distributions) will also be assumed.

Finally, one should not be averse to analytical thinking and quantitative analysis in general.

RECOMMENDED TEXTBOOKS

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

- *Practical Management Science* (5th edition), by Wayne Winston and Chris Albright, 2016.
- *Essentials of Business Analytics* (1st edition), by Jeffrey D. Camm et al., 2015.

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* (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. 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). 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.

COURSE SCHEDULE (subject to minor changes)

Session	Topics	Applications
Session 1	**Course Introduction** **Linear Optimization: Formulation** **Linear Optimization: Solver**	• Product Mix • Capital Budgeting • Staff Scheduling • Marketing Research
Session 2	**Sensitivity Analysis** **Alternative Optimal Solution**	• Airline Network Capacity Management • Optimize Click-through Revenue for Online Advertising • Portfolio Optimization
Session 3	**Multi-period Model**	• Production Scheduling • Project Funding • Pension Planning
Session 4	**Network Models**	• Logistic Planning • Currency Exchange
Session 5	**Integer Optimization: Assignment Problems** **Binary Variables: Logical Relations**	• Assigning School Buses • Airline Crew Scheduling • Online Dating Service • Capital Budgeting
Session 6 (**Assignment 1 Due**)	**Non-linear Optimization: GRG Solver**	• Portfolio Optimization (Markowitz Model) • Demand Curve and Pricing
Session 7	**Non-linear Optimization: Evolutionary Solver**	• Portfolio Optimization (Beat the Market) • Pricing Bundles
Session 8	**Linear Formulation of Non-linear Problems**	• Product Line Design
Session 9	**Simulation: Basics** **Simulation: Crystal Ball**	• Inventory Optimization • Retirement Planning • Simulating Cash Flow
Session 10 (**Assignment 2 Due**)	**Simulation: Financial Models**	• Option Pricing • Project Valuation • Cash Balance
Sessions 11 & 12	**Simulation: Marketing Models** **Simulation: Operations Models** **Simulation: Stochastic Optimization**	• Customer Lifetime Value • Reducing Churn • Predicting Sales of New Product • Project Management
Feb 3 (**Assignment 3 Due**)		