SYLLABUS
DECISION MODELS AND ANALYTICS

OPMG-GB.2350

MEETINGS

September 22nd – December 15th, Saturday 9am-12pm.

Classroom: KMC 2-70

INSTRUCTOR

Professor Jiawei Zhang
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OFFICE HOURS

Monday 12:30-1:30 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. NYU students have online access to these books.

- **Managerial Decision Modeling : Business Analytics with Spreadsheets, 4th Edition,** by Nagraj Balakrishnan, Barry Render, Ralph Stair, Chuck Munson, and Charles Munson

https://ebookcentral.proquest.com/lib/nyulibrary-ebooks/detail.action?docID=4947049

- **Optimization Modeling with Spreadsheets**, Second Edition, by Kenneth R. Baker

https://onlinelibrary.wiley.com/doi/book/10.1002/9780470949108

- **Financial Modeling with Crystal Ball and Excel, 2nd Edition,** by John Charnes

https://ebookcentral.proquest.com/lib/nyulibrary-ebooks/detail.action?docID=827132

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

At NYU Stern we seek to teach challenging courses that allow students to demonstrate differential mastery of the subject matter. Assigning grades that reward excellence and reflect differences in performance is important to ensuring the integrity of our curriculum.

In general, students in this elective course can expect a grading distribution where about 50% of students will receive A's for excellent work and the remainder will receive B's for good or very good work. In the event that a student performs only adequately or below, he or she can expect to receive a C or lower. The actual distribution for this course and your own grade will depend upon how well each of you actually performs in this course. The grades for this course will be based on homework assignments (60%), final exam (20%) and class participation (20%).

RE-GRADING

In line with the grading guidelines for NYU Stern, the process of assigning of grades is intended be one of unbiased evaluation. This means that students are encouraged to respect the integrity and authority of the professor's grading system and discouraged from pursuing arbitrary challenges to it.

If a student feels that an inadvertent error has been made in the grading of an individual assignment or in assessing an overall course grade, a request to have that the grade be re-evaluated may be submitted. Students should submit such requests in writing to the professor within 7 days of receiving the grade, including a brief written statement of why he or she believes that an error in grading has occurred.

CLASS PARTICIPATION

The professor will judge class participation on the extent to which you appear prepared, the relevance and depth of your comments, the degree to which you listen carefully and respond to your peers, and your willingness to take chances in order to further the educational experiences of others. You will lose participation points if you miss classes and/or arrive late and/or leave early multiple times.

HOMEWORK

There are five homework assignments in total. All assignments will be posted on NYU Classes. You should submit both a **printout** (in class) and an electronic copy (via e-mail to the **sterndmazhang@gmail.com** with subject line **"Graduate Decision Models Homework #X"**, before class). Keep a copy of all homework submitted.

Late assignments will not be accepted unless due to documented serious illness or family emergency. Professor will make exceptions for religious observance or civic obligation only when the assignment cannot reasonably be completed prior to the due date and the student makes arrangements for late submission with the professor in advance. **You can collaborate with a single colleague in solving the homework questions, but you must acknowledge that in your submission. The assignments must be submitted individually in order to receive credit.**

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 & Solver** **Resource Allocation Models**	• Product Mix • Capital Budgeting
Session 2	**Resource Allocation (Cont'd)** **Sensitivity Analysis** **Cost-Benefit Models**	• Airline Network Capacity Management • Optimize Click-through Revenue for Online Advertising • Staff Scheduling
Session 3 **(Assignment 1 Due)**	**Multi-period Models** **Inventory Variables**	• Production Scheduling • Project Funding • Pension Planning
Session 4	**Network Models**	• Transportation Problem • Logistic Planning • Currency Exchange
Session 5 **(Assignment 2 Due)**	**Integer Optimization** **Assignment Problems** **Binary Variables: Logical Relations**	• Capital Budgeting • Professor Scheduling • Assigning School Buses • Online Dating
Session 6	**Non-linear Optimization: GRG Solver**	• Portfolio Optimization (Markowitz Model) • Demand Curve and Pricing
Session 7 **(Assignment 3 Due)**	**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 **(Assignment 4 Due)**	**Simulation: Basics** **Simulation: Crystal Ball**	• Inventory Optimization • Retirement Planning • Simulating Cash Flow
Session 10	**Simulation: Financial Models**	• Option Pricing • Project Valuation • Cash Balance
Sessions 11 **(Assignment 5 Due)**	**Simulation: Marketing Models** **Simulation: Operations Models**	• Customer Lifetime Value • Predicting Sales of New Product • Market Shares • Project Management
Session 12	**Simulation: Stochastic Optimization** **Final Exam**	• Airline Overbooking