MGSC 608: DATA, MODELS, AND DECISIONS

Fall 2010

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CLASS MEETINGS
Every Thursday, 6:05pm- 8:55pm, Bronfman 360.

ACADEMIC INTEGRITY
McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offenses under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/integrity for more information).

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COURSE MATERIAL
Required textbook: *Data, Models, and Decisions: The Fundamentals of Management Science* (Hardcover), 2nd edition. Dimitris Bertsimas, Robert Freund. Dynamic Ideas, 2004. ISBN 0-9759146-0-X.

In addition, there is a required course pack. Announcement about additional reading materials will be made later in class. Links or electronic files will be posted on WebCT.

INTRODUCTION

In this course we explore and develop skills and techniques that help students become effective decision makers. The emphasis is on analytical modeling of business problems from marketing, finance, operations, production, logistics, and performance measurement. The main objective is to improve managerial decision making in the functional and cross-functional business areas. We introduce a number of modeling concepts that are used behind the screen of many Decision Support Systems, including linear programming, integer programming, decision trees, and Monte Carlo simulation. We point out how these concepts can be used to model and effectively help to solve a wide range of business problems. Through examples, class discussion, case studies and computer workshops the students become familiar with the concepts, the solution approaches, their limitations and underlying assumptions, and practical use. We also teach you to use some Excel-based decision support tools to analyze business problems. If time allows, we will also introduce revenue management and pricing, which exemplifies extensive use of the concepts and tools introduced in this course.

GRADING SCHEME

Your course grade will be based on the midterm exam, three group assignments, a course project, and class participation. The breakdown is as follows:

- Midterm exam		35%
- 3 group assignments (10% each)		30%
- Course project		25%
First progress report	1%	
Second progress report	1%	
Project presentation	10%	
Final report	13%	
- Class participation		10%

The midterm exam will be open book/open notes exam. However, only the textbook and course materials from this class are allowed. The 3 group assignments will be linked to 3 workshops held in class. The course project is an integral part of the course. Students are expected to use the tools from this course to solve a real world problem. Group assignments and the course project should be done in groups of 3 to 4 students. Class participation includes participation in class discussion and the effort devoted to the course as a whole.

COURSE OBJECTIVES

The aim of the course is:
- to develop analytical skills to structure and model business decision problems;
- to introduce and extend methodologies and solution techniques for quantitative modeling and interpret solutions;
- to discuss applications in many functional areas (operations and logistics, finance, strategy, marketing, …);
- to develop practical skills in solving these problems by hands-on experience with Excel-based decision support tools.

DETAILED COURSE PLAN

Class 1: Management science and modeling
Abstracting the essential features of a complex situation is a key skill for effective decision making. We address this abstraction process and provide guidelines for translating real-life problems into formal models that can be analyzed using quantitative techniques. We also discuss how to implement these models in a spreadsheet environment.

Classes 2, 3, 4, 5: Linear and integer programming
Linear and integer programming is a powerful technique for allocating scarce resources to various activities to best meet organizational objectives. We provide an introduction into this technique. A case study is used to discuss issues such as problem analysis, model building, economic interpretation of the solution, and problem solving with Excel Solver. There are many further applications of these techniques, such as planning problems in production and logistics, the selection of projects within a limited budget in finance, or the planning of an advertising campaign in marketing.

Classes 6, 7, 8: Decision Analysis
These lectures explain how to structure and solve problems with decision trees. We also look at the value of perfect and imperfect information and introduce Bayes' rule. In the process, we review concepts from probability theory and statistics useful for decision tree analysis. We discuss the use of decision trees through case studies.

Classes 10, 11, 12: Simulation
In many decision situations – whether it is an operational, tactical or strategic decision - uncertainty plays an important role and makes it difficult to analyze these problems. Simulation provides a flexible, powerful, and intuitive tool for doing this. We discuss the use of simulation through several cases. A basic insight is that reasoning on average values leads to wrong decisions. The software used is Crystal Ball.

Class 13: Project presentation
Depending on the number of groups, each group will be given 15 to 20 minutes to present the model, analysis, and insights from their course project. Each project will be graded based on the in-class presentation by the instructor and each student. The project presentation will count 10% towards the final grade.

COURSE OUTLINE

Session	Date	Topics	Readings	Assignments
1	9/2/2010	Management science and modeling		
2	9/9/2010	Linear Programming 1	Textbook: Chapter 7	
3	9/16/2010	Linear Programming 2	*Preparation:* Case: Filatoi Riuniti	First assignment
4	9/23/2010	Linear Programming Workshop Q&A for projects	Excel tutorial (skip if you find it elementary)	First assignment due First progress report for course project due
5	9/30/2010	Integer programming 1	Textbook: Chapter 9 *Preparation:* Case: International Industries	
6	10/7/2010	Decision Analysis 1	Textbook: Chapter 1	
7	10/14/2010	Decision Analysis 2	*Preparation:* Case: Kendall Crab and Lobster, Inc. *Read*: Practice Paper: SmithKline Beecham	Second assignment
8	10/21/2010	Decision Analysis Workshop Q&A for projects		Second assignment due Second progress report for course project due
9	10/28/2010	Midterm exam	Good luck!	
10	11/4/2010	Simulation	Textbook: Chapter 5	
11	11/11/2010	Simulation	*Preparation:* Case: The Gentle Lentile Restaurant	Third assignment
12	11/18/2010	Simulation Workshop Q&A for projects		Third assignment due
13	11/25/2010	Project presentation	Good luck!	Final course project report due

Note:

1. Readings should be done BEFORE each class. All assignments and reports are due BEFORE the class starts on the due date. Late submissions will NOT be accepted.

2. Please bring laptops for use in class for workshops (9/23, 10/21, 11/18).

3. While it is my intention to follow the above timetable, slight adjustments may be required.

How revenue management is covered in the course

This DMD course is organized by different modeling techniques and tools, and revenue management is covered as an application area to motivate and illustrate the different topics, in particular simulation and linear programming.

The following materials on revenue management are used in the course:

1. A set of slides titled "Revenue Management: Fundamentals, Current Practice, and New Development". This set of slides covers some basic RM concepts and discusses state-of-the-art RM practices. This set of slides was previously developed for an executive short course on revenue management delivered to a corporate client.
2. A mini-case titled "Revenue Management at Air Canada (A)". This mini-case involves a revenue management problem with two fare classes and is used to illustrate Littlewood's Rule.
3. A mini-case titled "Revenue Management at Air Canada (B)". This mini-case involves a revenue management problem with three fare classes. This mini-case is used to showcase Crystal Ball simulation tool. OptQuest is used to optimize protection levels. The solution from the simulation tool is compared with the solution from a marginal revenue approach developed in Excel.
4. A mini-case titled "Central Airlines Seats Configuration". This case involves optimizing seats configuration when demands for different fare classes are uncertain and the seats for each class can differ in space requirement. A linear programming model is used to solve the problem.

In addition to the in-class materials, I also assign homework problems related to revenue management. The homework assignments are typically tied closely with the in-class materials.