University of Pennsylvania

The Wharton School

Department of Operations, Information and Decisions

OIDD 612: *Business Analytics*

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Course Description

OIDD 612 is a course on the use of decision models for business analytics. Its main topics include constrained optimization and decision making under uncertainty. The emphasis is on models that are widely used in diverse industries and functional areas, including operations, finance, accounting, and marketing.

The applicability and use of these models have increased dramatically in recent years due to extraordinary improvements in computer, information, and communication technologies. Large volumes of data are available from automatic capture of point-of-sale (POS), Enterprise Resource Planning (ERP), and Customer Relationship Management (CRM) systems.

Information has come to be recognized as a critical resource, and models play an increasingly critical role in deploying this resource, in organizing and structuring information, so that it can be used more productively. Friendly interfaces have become effective "delivery vehicles" for powerful decision models, that enable the use of these data for more effective short-term, operational and long-term, strategic decision making.

The course has a twofold purpose. First, it seeks to introduce you to simple models and ideas that provide useful (and often surprising) *qualitative* insights about a large spectrum of managerial problems. Second, it aims to give you a feeling for the kinds of problems that can be tackled quantitatively, the methods and software available for doing so, and some of the issues involved in gathering the relevant data. Whether or not you explicitly use these decision models in the future, we believe the course will have impact on the way you think about available data and how it can be used to provide more value in management decisions.

Text

Cliff T. Ragsdale, *Spreadsheet Modeling and Decision Analysis,* Revised 5th Edition, Cincinnati: South-Western College Publishing, 2008, 7 selected chapters.

We have put several copies of the text on reserve at Lippincott Library.

Canvas Site

The course has a web site on Canvas from which you can download all printed materials that are handed out in class. The Canvas site will also have Excel files with sample solutions to homework problems, solutions to the textbook's end-of-chapter problems, software, and other materials of interest.

Computer Software

We will use *Microsoft Excel* spreadsheets extensively throughout the course. In the first half we will also use Excel's *Solver* add-in to solve constrained optimization problems, and in the second we will use *Crystal Ball*, an add-in for Monte Carlo simulation. You will be able to download Crystal Ball from the course web site.

Homework Assignments

Working on these problems is essential to your mastery of the material. There are ***three* written homework assignments.** Homework assignments may be done **individually or in pairs**. If you do an assignment as part of a pair, **please hand in *one* write-up** with two names on it. (*Do not* hand in two copies of the same assignment.)

Please hand in assignments at the **beginning of class** and remember to include your **name(s) and student ID(s)**.

You are free to discuss all three homework assignments with other students. When thinking of whether to work alone or not, you may consider the following trade-offs. Working alone has the advantage that you get the best insight into how well you are mastering the material. On the other hand, particularly if this material is entirely new to you, you may find that discussing the problem with another person helps in the learning process.

We will also distribute a set of "self-study" problems and their solutions. The self-study questions will be similar to homework sets. Together, the homework and self-study problems will give you a good idea of the kind of questions you can expect on the final exam.

Group Project

In the group project you will apply the approaches you are learning in class to an important real-world decision making problem based on your own experience. The problem should be one that a member of your group has encountered, either at work, in a consulting assignment, in a club or other organization.

There are two project deliverables: (1) part-way through the course, you will hand in a one-page proposal and then meet with the instructor to discuss the problem and your approach to modeling and solving it; and (2) during the last class your group will make a brief oral presentation describing the project and will hand in a zip file that contains your models, data sets, presentation, and anything else a user would need to understand the project.

We will provide more details on the project and deliverables in a separate note.

Examination

The final examination for the course will be held on **Wednesday, May 3, from 3pm to 5pm**, rooms TBA. We will use a common examination for all sections of the course offered in a given quarter. The examination will be open-book, open-notes. A practice examination with solutions will be distributed on or before the last class session.

Grading

The course grade will be based on a weighted average of the points earned on homework exercises, the group project, the final examination, and class participation. The weights are as follows:

Homework exercises	10%
Group Project	20%
Final examination	55%
Class participation	15%

Class Schedule

The schedule below provides a class-by-class view of topics, associated readings, and course deliverables.

Class	Q4 Date	Session	Notes / Suggested Readings	Due
1	Mar 13	Introduction	• **Text–1; 1–13:** Sketches of applications. • **Text–2; 17–39:** Geometry of linear optimization problems, for intuition.	
2	Mar 15	Interpreting Optimization Results Constrained Optimization and Economics	• **Text–3; 45–62:** Formulating a linear optimization problem and implementing it in a spreadsheet. • **Text–4; 136–151:** Sensitivity analysis. • **Notes from Class #1** - ***Fabulous Nuts***: We'll discuss this problem in class.	
3	Mar 20	Network Applications I	• **Text–3; 63–102**: Many examples: in class we'll cover those listed in 3.10 and 3.12. • **Notes from Class #2 – *GlobChem:*** We'll discuss this problem in class.	
4	Mar 22	Network Applications II	• **Notes from Class #3 – *RE Investment***: We'll discuss this problem in class.	HW 1
5	Mar 27	Integer models	• **Text–6; 232—268:** Integer models, examples. We will focus mainly on *binary* variables.	
6	Mar 29	Decision Making Under Uncertainty	• Decision Trees: test marketing; the value of information.	
7	Apr 3	Introduction to simulation	• **Text–12; 559–586:** Basics of Monte Carlo simulation.	HW 2
8	Apr 5	Risk management	• Asian options.	
9	Apr 10	Optimization via simulation	• Newsvendor problem.	Project Proposal
10	Apr 12	Nonlinear Optimization Using Scenarios to Model Uncertainty	• Portfolio analysis.	
11	Apr 17	Decision Trees and Optimization	• Clinical trials.	HW 3
12	Apr 19	Project Presentations	• Your show!	Project Slides

Class Preparation

The class moves quickly, and your completion of assigned readings *before* class will help you to prepare for what's covered in class and to better keep up.

Assigned readings are marked **Text–*m*; *ppp–qqq*** and refer to Chapter *m*, pages *ppp–qqq* of the Ragsdale text. When reading the textbook, you should make a distinction between the mathematical models and their spreadsheet

implementation. It is useful at first reading to focus on the mathematical models and skim through the spreadsheet details.

At the start of most classes we will hand out detailed lecture notes that are designed to help you focus on the class discussion rather than on note taking. It is good practice to review these lecture notes soon after each class to reinforce your learning from the class.

TA Office Hours

Teaching assistants' (TAs) office hours will be posted on Canvas. All sections of the course in a given quarter have the same assignments and exam, and you may approach any of the TAs with questions.

Ethics Matrix

The course involves a mix of work by individuals, pairs, and groups, and the matrix below describes who you are allowed to work with and what materials you are allowed to use for each assignment. It is your responsibility to understand and follow the matrix.

	Materials						People				
OIDD 612: Business Analytics	Approved calculator	Laptop / other electronics	Current book, class notes	Past notes / summaries	Past exams / assignments	Internet content / other outside materials	Approved work team	Other student(s) in same section	Student(s) in other sections (same term)	Wharton student not taking the class this term	Person outside of Wharton
Homework	A	A	A	A	A	A	W	D	D	D	D
Project	A	A	A	A	A	A	W	D	D	D	D
Final Exam	A		A								
	A = Allowed material Shaded Cell = Not allowed						W = Allowed to work together D = Discussion of general concepts and procedures is allowed but no sharing of specific answers. Shaded Cell = Not allowed				

Notes:

Homework can be done alone or in a pair. You may discuss homework problems with people outside of your homework partner but you may not share specific answers with people outside of your homework partner.

Projects can be discussed with those outside of your work team. Specific project work should only be done by those on your project team.

Final exam preparation can be done with others. The materials you bring to the final exam may only include the course book, notes handed out in class and/or posted on the course web site, your own written notes, and a calculator.