BUDT 758P: Decision Analytics
Fall 2015, TuTh 2:00 – 3:15 p.m.
Syllabus

1. Course staff

- Prof. Ilya O. Ryzhov (iryzhov@rhsmith.umd.edu)
  4322 Van Munching Hall
  Office hours: Thursdays 3:30 – 5:30 p.m.
- Vasudha Hegde, grader (vasudha.hegde@rhsmith.umd.edu)

2. Course objectives

What makes a decision difficult? Usually, the answer is that the decision requires us to spend scarce resources. A "resource" is any asset that can be leveraged to achieve business objectives: time, money, staff, trucks, computer cores, and research effort can all be viewed as resources. When you decide to spend your resource on something (e.g., investing into a research project, or accepting a delivery job), there is less of the resource that can be spent on something else. You thus have to think carefully about the tradeoffs involved in allocating resources to one objective as opposed to another.

This class develops a quantitative framework for studying resource allocation problems. Resource allocation problems arise in many industries and areas such as transportation, electronics, advertising, finance, and health care. The specifics of each problem are very different. Nonetheless, all resource allocation problems, in all of these areas, have common elements that behave in exactly the same way. We will develop an abstract modeling language that emphasizes these common elements, so that you will be able to write down any resource allocation problem on paper and then apply standard tools (such as Microsoft Excel) to obtain solutions.

Assuming that your model is correct, Excel will (almost) always give you a solution that is guaranteed to be efficient. However, if you are unable to model the problem, the tools will not help you. Thus, the most important objectives are:

- Identify an underlying analytical *structure* in a seemingly complex and amorphous decision problem.
- Translate a verbal description of a decision problem into a valid optimization or simulation model.
- Interpret the meaning and assess the validity of a particular optimization model.
- Express a given optimization model in an Excel spreadsheet, and find solutions to these problems using the most appropriate algorithm and settings in Solver.
- Understand the role of *uncertainty* and *risk* in the decision-making process.

3. Is this course right for you?

Decision Analytics builds on concepts introduced in the core class BUSI 758B on "Data, Models and Decisions." Because BUDT 758P focuses on analytical models, it has a substantial quantitative dimension. Occasionally in class, I would like to get into some of the mathematical details underlying the course material. Still, this is a business course, not a math course. Good performance in prior math courses is not a guarantee of doing well in this course; conversely, if you have not done well in math courses in the past, there is no reason to believe that you will not do well in this course.

The fundamental difference between *Decision Analytics* and most of your prior math courses is that here problems will be "word problems." This calls for two distinctly different skills, both of which are absolutely essential for a successful performance in this course. On one hand, you will need **verbal** skills in order to quickly comprehend a situation from a short paragraph and in order to justify your calculations using a few short sentences. On the other hand, you will also need strong **analytical** skills in figuring out which particular technique to apply to the problem, as you understand it.

4. Textbooks

There is one required textbook:

Baker, *Optimization Modeling with Spreadsheets* (2nd ed.), Wiley.

Most (but not all) homework will be assigned from this book. Furthermore, the book also provides background on Excel. If I need to cover any material that is not in this book, I will post relevant readings on the course website in due time.

5. Software

This course focuses on the practical implementation of analytical techniques using computing technology that is widely used in the business world. We will use **Excel Solver**, **SolverTable** (an add-in introduced in BUSI 758B), and **@RISK** (part of the Palisade Decision Tools package that you used in BUSI 758B). All of this software will also be available on SmithApps (http://smithapps.rhsmith.umd.edu) for free use. If you are familiar with Risk Solver Platform (the upgraded version of Excel Solver), please feel free to use it. However, the in-class discussion will be based on Solver and @RISK.

Students are expected to be familiar with Excel at the level of BUSI 758B. Due to time constraints, class time will **not** be used to learn software skills. Please use the textbook and online manual for @RISK if you encounter software issues. Class time will be reserved for learning analytical principles and for discussing managerial implications of the analysis that is conducted. The assignments will provide a chance to master the software in practice.

6. Attendance

You are expected to attend **all sessions**. If you have to miss a class for an unavoidable reason, please let me know ahead of time. If you miss a class, you are responsible for catching up on all of the material, including completing homework assignments in a timely fashion. I am happy to meet with you in office hours if you run into difficulties.

7. Grading and deliverables

You should expect six homework assignments with quantitative content requiring you to model problems, and usually solve them in Excel. Every such assignment will be posted on Tuesday, and due two Tuesdays later.

In addition, you should expect 5-6 reading assignments. Each reading will consist of a paper published in *Interfaces*, an academic journal that specializes in industry applications (every submitted paper to this journal must be accompanied by a letter from a company certifying that the research generated significant business value). You will not have to solve any problems here, but I would like to use the readings for in-class discussions that will be announced ahead of time. For each of these discussions, I will randomly select several students from the class and ask them to prepare a group presentation on the reading. When you are selected, I will give you enough advance notice to prepare, and I will not ask you to make slides more than once (however, you are still expected to do all the readings and participate in the discussions).

There will be one midterm exam on **Tuesday, November 3rd**. There will also be a final exam at the end of the semester (date TBA). Your final grade will be determined according to the following scale:

- Class participation: 10%
- Homework assignments: 30%
- Midterm exam: 30%
- Final exam: 30%

Class participation includes not only preparation for the discussions, but also the demonstration of an ability to ask questions, provide comments and engage in constructive class discussion. You may discuss the quantitative homework with others, but you must make and submit your own spreadsheets. Because it is important to keep the course on track, **late homework cannot be accepted**. Please let me know ahead of time if there is any issue with submitting the homework by the due date.

8. Academic integrity

The University's Code of Academic Integrity is designed to ensure that the principles of academic honesty and integrity are upheld. All students are expected to adhere to this Code. The Robert H. Smith School does not tolerate academic dishonesty. All acts of academic dishonesty will be dealt with in accordance with the provisions of this

code. Please visit the following website for more information on the University's Code of Academic Integrity: http://www.president.umd.edu/policies/docs/III-100A.pdf. On each exam or assignment you will be asked to write out and sign the following pledge: "I pledge on my honor that I have not given or received any unauthorized assistance on this exam/assignment."

9. Course website

The course website is located at: https://umd.instructure.com/

The course website has multiple purposes to facilitate your learning in this course. First, it will be a repository for the course handouts. Additionally, course homework, solutions, etc. will be posted on the website. You can use the website to ask me questions (although email works too).

The course website must be used to submit homework assignments. Please type up your homework assignments using Microsoft Word or whatever other package you use for word processing. You should design your spreadsheets so that they are easy to follow. It is easy to annotate spreadsheets by adding text boxes or typing in nearby cells. When you submit your homework, if it is a single file, name your file your login name under the course website system followed by HW1.xls or HW1.doc. For example if my login name were *ryzhov*, I would submit the homework as *ryzhovHW1.xls*. If you have more than one file, create a single .zip or .rar file containing all your files. In this case when you submit the assignment, call your file your login name followed by the assignment number and the extension .zip. For example if I were submitting multiple files, I would use the file name *ryzhovHW1.zip*.

10. Special needs policy

Any student with special needs should bring this to the attention of the instructor as soon as possible, but not later than the end of the first week of class.

11. About the instructor

Ilya O. Ryzhov is an Assistant Professor of Operations Management and Management Science at the Robert H. Smith School of Business, University of Maryland. He joined the Smith School in 2011 after obtaining a Ph.D. in Operations Research from Princeton University. He teaches courses in decision models and optimization, and works on applications in revenue management, non-profit fundraising, and transportation, using models from optimization, statistics, and simulation to provide decision support and managerial recommendations. He was the recipient of the 2012 Best Theoretical Paper Award at the Winter Simulation Conference (finalist for the same award in 2009), and a finalist of the 2014 INFORMS Junior Faculty Forum Best Paper competition. He is a co-author of the book *Optimal Learning* (2012, Wiley), which discusses the problem of collecting information to improve decision-making.