BUDT 758P: Decision Analytics
Fall 2019, TuTh 9:30 a.m. – 10:45 a.m.
Syllabus

1. Course staff

- Prof. Ilya O. Ryzhov (iryzhov@rhsmith.umd.edu)
  4347 Van Munching Hall
  Office hours: Mondays, 1:00 p.m. – 3:00 p.m.
- Yupeng Cui, grader (yupeng.cui@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 have common elements that behave very similarly. 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 (e.g., 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 main goal of the course to develop a *structured, systematic way of thinking* about complex decision problems. The models that you develop can be expressed in Excel spreadsheets, but the modeling dimension itself is the most important skill that will be developed in this course.

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. 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 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

I will use the following textbook:

Baker, *Optimization Modeling with Spreadsheets* (3rd ed.), Wiley.

Most (but not all) homework will be assigned from this book. I will post scanned PDFs of the homework problems, so you do not need to buy the book solely for the problems. However, the book also provides background on Excel and is a valuable study aid, so I will refer you to it if you ask for study material. If I need to cover any topics that are not in the book, I will post relevant readings on the course website in due time.

5. Software

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 vSmith (http://workspace.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 6-7 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. Because it is important to keep the course on track, **late homework will not be accepted**. Please let me know ahead of time if there is any issue with submitting the homework by the due date. I will not entertain any requests for late submissions – especially not on short notice – without a compelling reason.

In addition, you should expect 6-7 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). These readings will be used for in-class discussions that will be announced ahead of time. For each of these discussions, I will randomly select 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, October 22nd**. 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 and presentation: 10%
- Homework assignments: 30%
- Midterm exam: 30%
- Final exam: 30%

When doing the homework, you must make and submit your own spreadsheets. Do **not** share spreadsheets or discuss the homework with others. Students are much more likely to do well on the exams when they minimize outside contact and work through everything on their own. Please note that **no extra credit** will be permitted at any point in time throughout the semester.

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 required to adhere to this Code. The Robert H. Smith School does not tolerate academic dishonesty. Graduate students are held to a higher standard than undergraduates with regard to academic integrity. 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 Associate 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 received the 2012 Best Theoretical Paper Award at the Winter Simulation Conference (finalist for the same award in 2009 and 2016), as well as the 2017 INFORMS Outstanding Simulation Publication Award, and was a finalist of the 2014 INFORMS Junior Faculty Forum Best Paper competition. At the Smith School, he received the Distinguished Teaching Award three times. He is a co-author of the book *Optimal Learning* (2012, Wiley), which discusses the problem of collecting information to improve decision-making.