# BUDT758P: Decision Analytics
## Syllabus

**INSTRUCTOR**

Dr. S. (Raghu) Raghavan
Professor of Management Science and Operations Management
Smith School of Business & Institute for Systems Research
- Contact: raghavan@rhsmith.umd.edu & raghavan@umd.edu (e-mail), 301-405-6139 (phone).
- Office location: Van Munching Hall 4365.
- Website: http://www.terpconnect.umd.edu/~raghavan
- Office hours: Tuesdays and Thursdays from: 5:00 pm – 6:00 pm.

**COURSE OVERVIEW**

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. allocating staff to a research project, or accepting a delivery job), there is less of the resource that can be spent on something else. You thus should think carefully about the tradeoffs involved in allocating resources to make the best decision possible.

In this course, we will develop a quantitative framework and explore basic analytical principles that can guide a manager in making complex resource allocation decisions. Optimization deals with design and operating decisions for complex systems. Simulation deals with the analysis of operating decisions of complex systems in an uncertain environment to assess risk or to deal with uncertainty. This course provides the student with a collection of optimization and simulation modeling and solution tools that can be useful in a variety of industries and functions (e.g., transportation, marketing, finance, information systems, health care etc.). The main topics covered are linear, integer, and nonlinear optimization applications in a wide variety of industry segments, and Monte-Carlo Simulation and risk assessment. Extensive use of application oriented cases will be used 1) for develop modeling and analytical skills, and 2) to simulate decision making in a real-world environment.

**COURSE PRE-REQUISITES**

You are expected to be familiar with Excel. The course will not teach you Excel skills. Rather, the course will show you how to develop quantitative models and guide you in implementing them in Excel.

**COURSE OBJECTIVES**

On successful completion of this course students will be able to:
- 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.
- Perform sensitivity analysis by tracing the effects of varying a parameter on the optimal decision variables and the objective function.
- Understand the role of *uncertainty* and *risk* in the decision-making process.
- Use of Simulation models to assess risk.
- Build and run Monte-Carlo Simulation using @RISK.

## COURSE MATERIALS

- Required text: *Optimization Modeling with Spreadsheets Microsoft Excel* (3rd edition**)**, by Kenneth Baker, Wiley.
- *Many additional handouts will be provided in each class and online.* These include a chapter on simulation modeling, as well as cases. These will be posted on Canvas.
- Your text for BUSI630 also contains two Chapters on Simulation that correspond to the material covered in this class.

## SOFTWARE

An explicit goal of this course is to develop your ability to implement analytical techniques using contemporary computing technology. We will achieve this goal with the following strategy:

- The course will use Excel Solver, SolverTable, and @RISK (part of the Palisade Decision Tools Suite).

- **Class time will *not* be used to learn software skills.** Given the availability of the textbook and online manual for @RISK as a comprehensive reference on software issues, attempting to learn software skills in class is an inexcusably inefficient use of class time. Class time will be reserved for learning analytical principles and for discussing managerial implications of the analysis that is conducted.

- Mastery of the software is eventually accomplished not by simply reading the textbook or by watching a demonstration in class, but by actually using the software in the assignments, using the textbook as a handy reference.

## ATTENDANCE & CLASSROOM DECORUM

You are expected to attend **ALL SESSIONS**. If you must miss a class for an unavoidable please let the instructor know ahead of time. If you miss a class, you are responsible for catching up on all the materials including completing homework assignments in a timely fashion.

Course faculty strive to create a positive educational environment so that all students can achieve their potential. In turn, students are expected to conduct themselves with the utmost honor and integrity, and behave and perform as professionals. Expect to demonstrate respect for course instructors, your peers and yourself; participate in all course activities with purpose and a positive attitude; and abide by course and school policies. This professional behavior will serve you will in this class and in your life outside the classroom. Be a good citizen – refrain from cellphone usage, surfing the Internet and texting during class.

## GRADING & DELIVERABLES

Your overall grade for the course will be determined on the following basis:

- Homework Assignments 30%
- Midterm Exams (2) 35%
- Final exam 35%

**Grade Dispute:** If you feel your homework/exam was not graded properly you must follow these procedures to request a re-evaluation. Within one week of receiving the grade you need to document your concern in writing. You must indicate which questions you feel were graded incorrectly and clearly explain why you feel your answer is correct. This must be communicated in writing, not verbally. Your entire exam/homework will be regraded with special emphasis on the questions you feel were not correctly graded. Thus, something that was overlooked before may now be discovered and your new adjusted score could be lower than before. The amount of partial credit awarded on a question is a judgment call. As in baseball, judgment calls cannot be protested. Therefore, you may not resubmit your work for the purpose of obtaining more partial credit.

## COURSE WEBSITE

The course website is located at http://elms.umd.edu.

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 homeworks, solutions, etc. will be posted on the website. Use the course website to post questions/communicate. This will be the easiest and *fastest* way for me to respond to your questions.

The course website must be used to submit homework assignments (unless otherwise stated on the assignment). 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. When you submit your homework, if it is a single file, name your file your loginname under the course website system followed by HW1.xlsx or HW1.docx. For example, if my login name were raghavan, I would submit the homework as raghavanhw1.xlsx. If you have more than 1 file, use a program like 7Zip to create a single zip or rar file containing all your files. In this case when you submit the assignment, call your file yourloginname followed by the assignment number and the extension .zip. For example, if I were submitting multiple files, I would use the file name raghavanhw1.zip.

## 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."

**Acceptable Levels of Collaboration:** To help you avoid unintentional cheating, the following table lists levels of collaboration that are acceptable for each type of graded exercise. If you are ever unclear about acceptable levels of collaboration, please ask!

| |  |  |  |  |  |
|---|---|---|---|---|---|
| **Homework Assignments** | ✓ | ✓ | ✗ | ✗ | ✗ |
| **Exams** | ✗ | ✗ | ✗ | ✗ | ✗ |
| **Team Assignments** | ✓ | ✓ | ✗ | ✓ | ✓ |
| **Class Activities** | ✓ | ✓ | ✗ | ✓ | ✓ |

## INCLEMENT WEATHER

In case of inclement weather, check the University of Maryland homepage or call 301-405-SNOW to check on cancellation status. If classes are cancelled, schedules will be adjusted accordingly. It is very unlikely that exam dates will be changed from the dates stated in the syllabus. It is possible that the material covered on the exam might be adjusted.

## RELIGIOUS HOLIDAYS

It is University policy that students will not be penalized for religious observation. You shall be allowed, whenever possible, to make up academic assignments that are missed due to such absences. However, you must notify me in writing during the first week of class, so that we can make the appropriate accommodations.

## SPECIAL NEEDS

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 class. If you are a student with a disability that requires accommodation, you must provide me with documentation from Disability Support Services (DSS) by *the end of the first week of class*, so we can make appropriate arrangements. If you have a disability, but have not yet registered with the University, please do so by contacting DSS as soon as possible (301-314-7682 or 301-405-7683 TDD). Accommodations cannot be made without appropriate documentation.

## SOFTWARE INSTALLATION

*Computer requirements*: The software is supported on native **Windows** machines. The software works with Windows 7, 8, and 10, both 32-bit and 64-bit versions. The software requires Excel 2003–2016 for Windows (not Excel for Macintosh).

*Mac users*: If you have a Mac, you can try running the Palisade software in Windows under Bootcamp, Parallels, and VMWare, but if they don't work for you then neither our help desk nor Palisade can provide any assistance The University also provides Mac users licenses to install VMWare Fusion and Windows at no cost from Terpware.umd.edu if they have the appropriate equipment and drive space. See https://terpware.umd.edu/Mac/Package/2326 for more information about installing this.
The IT Helpdesk in Van Munching Hall is staffed to help them configure this on a walk-in basis if they have any trouble with it. As an alternative for Mac users, they can always use vSmith for both Excel (select Excel 2016) or @Risk. Note: Excel is a direct option within vSmith, but for @Risk, you will need to first access the Student Desktop.

The course uses **two** primary software tools, both working as add-ins within Excel. You can download Excel (if you don't ready have it) from Terpware and you can download @Risk from instructions provided on the course website.

The first primary tool you will use is Solver. This product is delivered with Excel, but you will need to select it as an active add-in. It is available in all versions of Excel for Windows, and is available for the MAC version of Excel from 2011 forward. You can access the following website for directions to activate Solver for both Windows and MAC computers: http://www.solver.com/excel-solver-how-load-or-start-solver

Another tool that we will use along with Solver is SolverTable. This tool can be accessed from the website of the developer, Chris Albright. The URL for this site is:
https://kelley.iu.edu/albright/free_downloads.htm

The second primary tool we will use at @Risk. This is one of the products that is part of the Palisades Decision Tools Software Suite. We will use the Simulation Component called @RISK.

**Instructions to access the Student Desktop within vSmith**. You access vSmith from the following URL: workspace.rhsmith.umd.edu

First you will select Student Desktop. After logging in with your UMD credentials, from the Start Menu, select in order the following: All programs\Stats and Analysis\Palisades Decision Tools\@Risk7. Be careful to save your work in one of the university shared drives, such as Box or Dropbox or on your own computer. See it.rhsmith.umd.edu/vSmith for more information on accessing vSmith and saving your work. Contact the Office of Smith IT Service Desk if you have difficulties installing or using vSmith at helpme@rhsmith.umd.edu.

The formal (or the "rules") part of the syllabus concludes here. What follows are informal paragraphs to help you understand the philosophy behind this course, my background, and some suggestions on mastering the various components of this course.

## WHO CAN DO WELL IN DECISION ANALYTICS?

*Decision Analytics* is not a math course. It is a business course. If you have done well in math courses in the past, you may possibly find it easy to understand much of the material. However, superior performance in prior math courses is absolutely no guarantee of doing as 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.

## TIPS ON STUDYING FOR THIS COURSE

**Attendance**: Try not to miss class meetings – given the cumulative nature of most sessions, it is usually impossible to adequately make up a missed session.

**Reading:** Complete the assigned reading for class. Otherwise, the pace of the class will seem too fast.

**Solving Problems**: Reading the textbook is necessary but not sufficient. To truly master the concepts (and software) it is essential to solve as many problems as possible – the textbook has many problems at the end of each chapter.

## INSTRUCTOR BACKGROUND

S. "Raghu" Raghavan is Professor of Management Science & Operations Management at the Robert H. Smith School of Business, University of Maryland, with a joint appointment with the Institute for Systems Research. He joined the Smith School in 1998 after several years in the telecommunications industry (where he led the Optimization Group at U S WEST Advanced Technologies). Raghu is passionate about using quantitative methods for better decision making. He enjoys teaching business analytics courses, and is a recipient of many teaching awards. These include (i) the INFORMS Prize for the Teaching of OR/MS Practice, (ii) the Legg-Mason Teaching Innovation award at the Smith School, and (iii) several Smith School Distinguished Teaching Awards. His research interests and activities cover a broad domain including---auction design, data mining, economics, information systems, computational marketing, logistics, networks, optimization, and telecommunications. He holds two patents, and has won numerous international awards for his practice-oriented research work. More details on his background and research can be obtained from his personal website.