INST 354: Decision-Making for Information Science

Section 0102
Tydings Hall 2109
Tue/Thu 2:00 PM - 3:15 PM

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Office Hours: Wednesdays 3pm - 4pm, Thursdays 3:30pm - 4:30pm, and by appointment.

A critical determinant of success for individuals and organizations is making good decisions. But why is it that we don't always make rational and logical choices? How can we improve the quality of our judgments and choices? To address these questions, the course will review:

- strategies for making rational choices;

- the psychology of judgment and decision making, including the roles of thinking strategies known as heuristics; and

- quantitative techniques for decision making, including optimization/linear programming and classification tree models.

Learning Objectives

After completing this course you will be able to:

- Use decision analysis to facilitate rational choice

- Recognize different descriptive judgment and decision-making strategies

- Solve an optimization problem

- Use classification models to inform decision making

Course Design

This course uses a **flipped classroom design**. In this course, you are responsible for watching video recorded lectures and reading the required literature for each unit before you come to class. Students will then have the chance to discuss the materials and work on example problems and exercises in class.

Because we will be using class time to do assignments, you must bring your laptop to class every day (with a few exceptions). If you do not have a laptop, please contact me after the first class.

To learn more about the flipped classroom design and why I am using it, you can check out this link: `https://facultyinnovate.utexas.edu/flipped-classroom`

Course Workflow

For our flipped classroom design, we will have the following general course workflow.

Before class:

- Watch the online video lectures (most by Professor Antoun).

- Do the readings.

- Make note of any questions or comments you might have.

During class:

- Bring your laptop.

- Answer the quiz questions.

- Work through the in-class exercises.

After class:

- Finish up any exercises you didn't complete in class.

- Come to office hours to clarify any remaining questions you might have.

Course Materials

Required Readings

Completing the required reading for the class is essential to understanding the core statistical concepts. In order to learn, you must review the material multiple times. The required reading listed below in the course schedule is given for the main textbook used in the class. There are a few advanced topics that are beyond the course textbook, and readings for these sections will be posted on Elms/Canvas.

Required Textbook

- Reid Hastie & Robyn Dawes, *Rational Choice in an Uncertain World*, 2nd Edition. Sage. Electronic version for sale here:
  `https://us.sagepub.com/en-us/nam/rational-choice-in-an-uncertain-world/book231783`

Required Software

- Microsoft Excel. For Macintosh users it is available through the universitys TERPware website (`https://terpware.umd.edu`).

- R software. It is free and available online (`https://www.r-project.org/`). You may want to use R Studio (the free version), which is an integrated development environment for R (`https://www.rstudio.com/`).

Course Activities

In-class Assignments (40% of grade)

There will be a total of 10 in-class assignments designed to assess your mastery of the topics and techniques covered in the lectures. This will consist of both a short in-class quiz about topics covered in the online lecture and readings, as well as exercises to practice applying the concepts for that week. Though these are designed to completed in class, you can finish up any work that needs to be done before turning it in later that week. Completed assignments will be submitted via Elms/Canvas due by 11:59pm on the scheduled due date, typically on Friday of that week.

Midterm Project (15% of grade)

You will work on a short 2-page midterm project due at the end of Week 7 (March 15). If you anticipate that this due date will problematic for any reason, please let me know ahead of time. More information about the midterm project will be provided in Week 5.

Final Project(35% of grade)

You will work in group of 3 or 4 people on a final project using concepts covered in class. This project will be due during Finals week. Class time will be set aside to help you work together in your groups. More information about the Final Project will be provided in Week 12.

Final Presentation(10% of grade)

You will give a 5 minute presentation of your group project in the final two class periods. This will be based on the group Final Project, and is a chance for you to get feedback on your work before turning it in.

Grading

Grades will be assigned based on the total percent earned, using the following rubric. Grades will be rounded to the nearest 10th of a percent. Please come and talk to me early if you think that there might be a problem.

A+	97.0-100.0%	B+	87.0-89.9%	C+	77.0-79.9%	D+	67.0-69.9%	F	0-59.9%
A	93.0-96.9%	B	83.0-86.9%	C	73.0-76.9%	D	63.0-66.9%		
A-	90.0-92.9%	B-	80.0-82.9%	C-	70.0-72.9%	D-	60.0-62.9%		

Course Policies

Late Work

Timely submission of the completed assignments is essential. The due date of each assignment will be stated clearly in the assignment description. Late homework will be subject to a 10% penalty for each day it is late, up to a maximum of 50%.

Campus Policies

Please visit `http://www.ugst.umd.edu/courserelatedpolicies.html` for the Office of Undergraduate Studies full list of course related policies and follow up with me if you have questions. It is our shared responsibility to abide by the University of Marylands policies.

Academic Dishonesty

Cheating in any form (copying, falsifying signatures, plagiarism, etc.) will not be tolerated. It will result in a referral to the Office of Student Conduct irrespective of scope and circumstances, as required by university rules and regulations. There are severe consequences of academic misconduct, some of which are permanent and reflected on the students transcript. If you have any questions regarding the Universitys policies on scholastic dishonesty, please see `http://osc.umd.edu/OSC/Default.aspx`. It is very important that you complete your own assignments, and do not share files (excluding raw data), partial work or final work.

University of Maryland Code of Academic Integrity

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit `http://shc.umd.edu/SHC/Default.aspx`.

Accomodations

Please come and see me as soon as possible if you think you might need any special accommodations for disabilities. In addition, please contact the Disability Support Services (301-314-7682 or `http://www.counseling.umd.edu/DSS/`). Disability Support Services will work with us to help create appropriate academic accommodations for any qualified students with disabilities. If you experience psychological distress during the course of the semester you can get professional help at the Counseling Center (301-314-7651 or `http://www.counseling.umd.edu/`)

Tentative Course Schedule

All readings, assignments, and due dates are subject to change. Refer to ELMS for the most current version of activities and due dates. "RC" refers to the textbook, while "R-1", "R-2" and so on refer to the readings shown in the next section.

Week	Dates	Topic
1	1/28 - 2/1	**Introduction and Course Overview; What is a "Decision"?** *Lecture Videos:* • 1.1 Course Overview • 1.2 What is a "Decision"? • 1.3 Quality of Choices *Readings:* • RC Chapter 1 • RC Chapter 2, pp 23-26
2	2/4-2/8	**What is Decision Analysis?; Payoff Matrix** *Lecture Videos:* • 2.1 What is Decision Analysis? • 2.2 The Payoff Matrix • 2.3 Creating a Payoff Matrix in Excel *Readings:* • R-1, pp 803 - 817 • R-2, pp 736 - 751
3	2/11-2/15	**Decision Trees** *Lecture Videos:* • 3.1 Decision Trees • 3.2 Decision Trees for Multistage Problems • 3.3 Creating a Decision Tree in Excel *Readings:* • RC Chapter 2, pp 26 - 32 • R-2, pp 751- 753
4	2/18-2/22	**Sensitivity Analysis and Bayes' Theorem** *Lecture Videos:* • 4.1 Decision Trees cont. • 4.2 Conditional Probabilities and Bayes' Theorem • 4.3 Using Excel for Sensitivity Analysis *Readings:* • R-2 pp 759 - 775

5	2/25-3/1	**Considerations/Pitfalls in Decision Analysis**

Lecture Videos:
- 5.1 Considerations/Pitfalls in Decision Analysis
- 5.2 Decision Analysis: Bad Information

Readings:
- RC Chapter 2, pp 32-42
- R-1 pp 817 - 832

6	3/4-3/8	**Utility Theory; Prospect Theory; and Decision Weights**

Lecture Videos:
- 6.1 Utility Theory; Prospect Theory; and Decision Weights
- 6.2 Prospect Theory
- 6.3 Decision Weights
- 6.4 Example - Using Utilities and Decision Weights

Readings:
- RC Chapter 11, p 237-241
- R-4
- RC Chapter 12

7	3/11-3/15	**Automatic vs. Controlled Thinking**

Lecture Videos:
- 7.1 Automatic vs. Controlled Thinking
- 7.2 Automatic vs. Controlled Thinking (part 2)
- 7.3 Limitations of Automatic Thinking

Readings:
- R-5

	3/18-3/22	**Spring Break**

8	3/25-3/29	**Heuristics**

Lecture Videos:
- 8.1 Heuristics
- 8.2 Skilled Intuitive Judgments
- 8.3 Other Descriptive Theories/Concepts

Readings:
- RC Chapter 4
- RC Chapter 5

9	4/1-4/5	**Optimization/Linear Programming**

Lecture Videos:
- 9.1 Optimization/Linear Programming
- 9.2 Maximization Examples
- 9.3 Minimization Example
- (Optional) 9.4 Graphical/Algebraic Solution

Readings:
- R-6

10	4/8-4/12	**Solving Optimization Problems in a Spreadsheet**

Lecture Videos:
- 10.1 Solving Optimization Problems in a Spreadsheet
- 10.2 Maximization Problem Example in Excel
- 10.3 Minimization Problem Example in Excel

Readings:
- R-7
- R-8
- R-9

11	4/15-4/19	**Sensitivity Analysis**

Lecture Videos:
- 11.1 Sensitivity Analysis
- 11.2 Sensitivity Analysis Cont.
- 11.3 Minimization Example

Readings:
- R-10

12	4/22-4/26	**Data-Driven Decision Making; Models vs. Human Judgment**

Lecture Videos:
- 12.1 Data-Driven Decision Making; Models vs. Human Judgment
- 12.2 Models vs. Human Judgment
- 12.3 Data-Driven Decision Making

Readings:
- R-11
- RC Chapter 3, p 53-67
- R-12

13	4/29-5/3	**Classification and Decision Tree Models**

Lecture Videos:
- 13.1 Classification with Decision Trees
- 13.2 Training and Testing Models
- 13.3 Evaluating Models
- 13.4 Overview

14	5/6-5/10	**In-class Project Time and Final Presentations**
15	5/13-5/14	**Final Presentations**

Readings (available on ELMS/Canvas if a URL is not provided)

R-1: Keeney, R. L. (1982). Decision analysis: an overview. Operations research, 30(5), 803-838.

R-2: Ragsdale, C. (2014), Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics, 7th Edition, Chapter 14

R-3: Magee, J. F. (1964). Decision trees for decision making (pp. 35-48). Harvard Business Review.

R-4: Gilboa, I. (2010). Rational choice. MIT press, Chapter 2, pp. 11-24.

R-5: Kahneman, D. (2011) Thinking, Fast and Slow, p 19-58

R-6: Ragsdale, C. (2014), Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics, 7th Edition, Chapter 2.

R-7: Introductory guide on Linear Programming for (aspiring) data scientists. Link provided on ELMS.

R-8: Optimization Methods in Management Science/Operations Research. Excel Techniques.

R-9: Linear Programming with Excel Solver. Available here: `http://faculty.sfasu.edu/fisherwarre/lp_solver.html`

R-10: Sensitivity analysis: strategies, methods, concepts, examples. Available here: `http://dpannell.fnas.uwa.edu.au/dpap971f.htm`

R-11: McAfee, A. (2014). When Human Judgment Works Well, and When it Doesnt. Harvard Business Review.

R-12: Provost and Fawcett (2013). Data Science and its Relationship to Big Data and Data- Driven Decision Making. Big data, pp. 51-59.