INST 354 - DECISION MAKING FOR INFORMATION SCIENCE
Spring 2020
ONLINE

Instructor: Dr. Christopher Antoun
E-mail: antoun@umd.edu
Office: 4105F Hornbake, South Wing
Office Hours: By appointment

Teaching Assistant (TA): Xiaoyi Deng
E-mail: xdeng01@umd.edu

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 data analysis approaches.

Learning Outcomes
After completing this course you will be able to:
- Describe the roles of quantitative analysis and of psychology of judgment in decision making
- Apply different decision analysis and data analysis techniques that can support decision making
- Explain how psychological processes can modify or restrain rational decision making
- Demonstrate hands-on experience with analytical techniques and software tools that are widely used in practice

The Pre–requisites for this course are: MATH 115 Precalculus, AND STAT 100 Elementary Statistics and Probability, AND PSYC 100 Introduction to Psychology, AND INST 314 Statistics for Information Science.

Course Format
This course is fully online. All readings, assignments, and lectures will be posted on Canvas. I have found that many students like the convenience and flexibility of online learning. However, it requires you to be more self-motivated and self-directed than a face-to-face class. I recommend setting calendar reminders for the different assignments and blocking off large chunks of time on your calendar during the weeks that exercises are due.

Required Resources
The following resources are necessary for you to successfully complete this course.
- The course website, www.elms.umd.edu
- One text book:
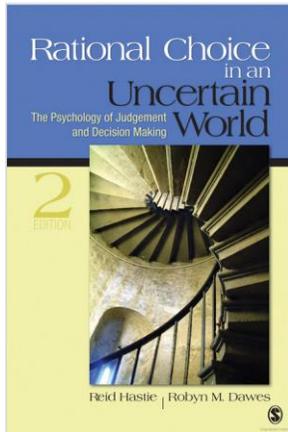
Reid Hastie & Robyn Dawes, *Rational Choice in an Uncertain World*, 2nd Edition. Sage. Electronic version for sale here: https://us.sagepub.com/en-us/nam/rational-choice-in-an-uncertain-world/book231783
(Hereafter **RC**)
Completing the required readings is essential to understanding the course material.

Required Software
The following software is necessary for you to successfully complete the course.
Microsoft Excel. For Macintosh users it is available through the university's 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/).

My Teaching Philosophy
To understand how I view my role as a teacher, please read my statement of teaching philosophy: https://sites.google.com/site/chrisantoun/teaching-philosophy

Communication with Instructor
If you would like to schedule a time to meet or if have questions about the materials, you are welcome to send me an email (antoun@umd.edu) I will try to respond within 48 hours. If you don't receive a response within 48 hours, feel free to send a follow-up email.

If you know in advance that you can't meet an assignment deadline, please let me know. Extensions will be granted under certain circumstances (personal problem, illness).

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 Maryland's policies.

Academic Integrity – Ethical work habits are critical for your professional success. I am aware of the pressures and opportunities that you have to copy/cheat and while I and the iSchool want to be supportive of those students who are encountering difficulties and/or make unintentional errors, we take this seriously and will be actively looking for and responding to incidents of

plagiarism and cheating. Thus, cases of academic misconduct will be referred to the Office of Student Conduct irrespective of scope and circumstances, as required by university rules and regulations. Visit http://osc.umd.edu/OSC/Default.aspx for more information about academic integrity.

Special Needs — Students with disabilities should inform me of their needs at the beginning of the semester. Please also contact the Disability Support Services (301-314-7682 or www.counseling.umd.edu/DSS). DSS will make arrangements with you and me to determine and implement appropriate academic accommodations. Students encountering psychological problems that hamper their course work are referred to the Counseling Center (301-314-7651 or www.counseling.umd.edu) for expert help.

Learning Assessments

Discussion Forum Participation (10%): Participation is a vital component of this course. You are expected to participate by posting to a weekly discussion forum. You will either be asked to respond to a discussion question that I post or to post your own original question about the readings. Your post is due by 11:59 PM on Thursdays. No late posts will be accepted. Please try to finish the readings and lectures for each week by Thursday night so that you are able to post a thoughtful comment. I recommend setting a calendar reminder about this. There will be no discussion forums on the weeks that exercises are due.

Please treat your fellow class members with respect in the online forums, just as they would in any face-to-face interaction. Visit www.albion.com/netiquette more details about etiquette in online communication.

Labs Participation (15%): You are expected to complete weekly lab assignments. These will involve different activities, including answering questions that I post and solving decision problems. You will generally be given full credit for completing the labs. These low-stakes assignments should provide you with an indication of your progress prior to the formal assessments (exercises, quizzes). Your lab assignments are due by 11:59 PM on Sundays. I recommend setting a calendar reminder about this. There will be no lab assignments on the weeks that exercises are due.

Exercises (36%): There will be four exercises. Each exercise will be graded on a scale of 0-10. They are due by 11:59 PM on the day that they are due. Due dates are indicated below under "Course Schedule."

The week that each exercise is due, I will hold a special group session of office hours (time and location TBD). It will be informal and give you a chance to ask me questions about the exercises.

Quizzes (25%): There will be four short quizzes to test your understanding of the concepts covered in the readings and lectures. They will be open book and open notes. We will drop your poorest quiz and the remaining 3 quizzes make up 25% of your grade. They are to be submitted by 11:59 PM on the day that they are due. Dates for each quiz are indicated below under "Course Schedule."

Case Study (14%): This is the final assignment. You will be presented with a case study scenario and asked to answer several questions about it. The assignment will be comprehensive in the sense that it is meant to assess your understanding of all parts of the course.

Collaboration
Here are specific guidelines about the forms of collaboration that are acceptable.

- Labs, Exercises, and Case Study: you may use your notes, consult the readings, search online, and work with other class members and in groups to figure out the underlying concepts and problem-solving processes, but are expected to work individually to answer the specific problems that are assigned.
- Quizzes: you may use your notes, consult the readings, and search online; however, you are expected to complete your own work, i.e. you may not communicate with other class members when completing these assessments.

Late Policy
You may turn in assignments up to three weeks past the due date for partial credit. No reason needs to be provided. Any late work must be turned in by the last day of class (May 12th). The penalties are as follows:

# days late	1	2-3	4-7	8-14	15-21
penalty	-5%	-10%	-15%	-20%	-30

For example, a grade of 90% on a homework assignment that this turned in 2 days late will be recorded as an 80%.
This policy does *not* apply to discussion forum posts, since no late posts will be accepted.

Letter Grades
Final letter grades are assigned based on the percentage of total assessment points earned. To be fair to everyone I have to establish clear standards and apply them consistently, so please understand that being close to a cutoff is not the same thing as crossing it (89.9 $\neq$ 90.0). It would be unfair to make exceptions for some and not others.

+	97.00%	+	87.00%	+	77.00%	+	67.00%		
A	94.00%	B	84.00%	C	74.00%	D	64.00%	F	<60.0%
-	90.00%	-	80.00%	-	70.00%	-	60.00%		

Course Schedule

'R-1", "R-2",… "R-5" refer to assigned readings that are shown below under "Readings."

Wk	Date	Tuesday
1	Jan 27-31	**Introduction and Course Overview; What is a "Decision"?** Readings: RC Chapter 1 RC Chapter 2, section 2.1 *Discussion Forum 1* *Lab 1*

                Module 1: Decision Analysis

Wk	Date	Tuesday
2	Feb 3-7	**What is Decision Analysis?; Payoff Matrix** Readings: R-1 (1st half: p 803-817) R-2 (p 736 – 751) *Discussion Forum 2* *Lab 2*
3	Feb 10-14	**Decision Trees** Readings: RC Chapter 2, sections 2.2-2.3 R-2 (p 751 – 753; p 759 – 775) R-3 *Discussion Forum 3* *Lab 3* Exercise 1 and Quiz 1 posted by Feb 17
4	Feb 17-21	**Considerations/Pitfalls in Decision Analysis** Readings: RC Chapter 2, sections 2.4-2.6 R-4 *Quiz #1 (due Thur Feb 20 by 11:59 PM)* *Exercise #1 (due Sun Feb 23 by 11:59 PM)*

                Module 2: Decision Theories

Wk	Date	Tuesday
5	Feb 24-28	**Utility Theory; Prospect Theory; and Decision Weights** Readings: R-5 RC Chapter 11, section 11.1 RC Chapter 12 *Discussion Forum 4* *Lab 4*
6	Mar 2-6	**Automatic vs. Controlled Thinking** Readings: R-6 Exercise 2 and Quiz 2 posted by Mar 9 *Discussion Forum 5*

		Lab 5
7	Mar 9-13	**Heuristics**
		Readings:
		RC Chapter 4
		RC Chapter 5
		Quiz #2 (due Thur Mar 12 by 11:59 PM)
		Exercise #2 (due Sun Mar 15 by 11:59 PM)
	Mar 16-20	*Spring Break*

Module 3: Mathematical Techniques to Inform Decisions

8	Mar 23-27	**Optimization/Linear Programming**
		Readings:
		R-7
		Discussion Forum 6
		Lab 6
9	Mar 30- Apr 3	**Solving Optimization Problems in a Spreadsheet**
		Video:
		https://goo.gl/AFcC7V
		Readings:
		R-8
		R-9
		R-10
		Discussion Forum 7
		Lab 7
		Exercise 3 and Quiz 3 posted by Apr 6
10	Apr 6-10	**Sensitivity Analysis**
		Readings:
		R-11
		Quiz #3 (due Thur Apr 9 by 11:59 PM)
		Exercise #3 (due Sun Apr 12 by 11:59 PM)

Module 4: Data Analysis to Inform Decisions

11	Apr 13-17	**Data-Driven Decision Making; Steps in Data Analysis Project; Types of Research Questions**
		Readings:
		R-12
		R-13
		R-14
		R-15
		Discussion Forum 8
		Lab 8
12	Apr 20-24	**Inferential Analysis Techniques**
		Readings:
		R-16

		R-17 (p 92-104)
		R-18
		Discussion Forum 9
		Lab 9
13	Apr 27- May 1	**Predictive Analysis Techniques** Readings:
		R-17 (p 104-111)
		R-19
		R-20
		Discussion Forum 10
		Lab 10
		Exercise 4 and Quiz 4 posted by May 4
14	May 4-8	**Predictive Models vs. Human Judgment**
		RC Chapter 3, sections 3.3-3.6
		R-21
		Quiz #4 (due Thur May 7 by 11:59 PM)
		Exercise #4 (due Sun May 10 by 11:59 PM)
		Case Study assignment posted by May 11
		Case Study Report (due Sun May 17 by 11:59 PM)

If there are updates to the schedule, they will be posted to Canvas.

Readings (**available on 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: Johnson, S. (Sep. 1, 2018). *How to make a big decision.* The New York Times. Available here: https://www.nytimes.com/2018/09/01/opinion/sunday/how-make-big-decision.html

R-5: Chand, S. *The Concept of Utility: It's Meaning, Total Utility and Marginal Utility | Economics.* Available here: http://www.yourarticlelibrary.com/economics/the-concept-of-utility-its-meaning-total-utility-and-marginal-utility-economics/8866

R-6: Kahneman, D. (2011) Thinking, Fast and Slow, p 19-58

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

R-8: Introductory guide on Linear Programming for (aspiring) data scientists. Available here https://www.analyticsvidhya.com/blog/2017/02/lintroductory-guide-on-linear-programming-explained-in-simple-english/

R-9: Optimization Methods in Management Science/Operations Research. Excel Techniques.

R-10: *Linear Programming with Excel Solver.* Available here http://faculty.sfasu.edu/fisherwarre/lp_solver.html

R-11: *Practical Optimization: A Gentle Introduction.* Chapter 6 – Sensitivity Analysis. Available here: *http://www.sce.carleton.ca/faculty/chinneck/po/Chapter6.pdf* Note: They refer to a software program that we are not using (LINDO) but the general principles apply.

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

R-13: Leek, J. T., & Peng, R. D. (2015). What is the question?. *Science*, *347*(6228), 1314-1315.

R-14: Peng, R. D., & Matsui, E. (2015). The Art of Data Science. *A Guide for Anyone Who Works with Data. Skybrude Consulting*. Chapters 2 & 3.

R-15: Ghani, Rayid. *Scoping Data Science for Social Good Projects.* Available here: https://dssg.uchicago.edu/2016/10/27/scoping-data-science-for-social-good-projects/

R-16: The "Online Stat Book". Chapter 14. Regression. Available here: http://onlinestatbook.com/2/regression/regression.html

R-17: The Art of Data Science. Chapter 7.

R-18: The Art of Data Science. Chapter 9.

R-19: *Decision Trees: An Overview*. https://www.aunalytics.com/2015/01/30/decision-trees-an-overview/

R-20: Why and How to do Cross Validation for Machine Learning. https://towardsdatascience.com/why-and-how-to-do-cross-validation-for-machine-learning-d5bd7e60c189

R-21: McAfee, A. (2014). *When Human Judgment Works Well, and When it Doesn't*. Harvard Business Review.