

Fall 2017 IE412/512: Decision Analysis

Time: 2:00 PM - 4:50 PM Friday

Place: O'Brian Hall 209

Web: Please use [UBlearns](#) to to assess all course information

INSTRUCTOR

Dr. Jun Zhuang, 317 Bell Hall

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*** The fastest and best way to reach me is by e-mail. ***

Phone: 716.645.4707 (Office)

Office hours: 1:00 PM-3:00 PM Wednesday

TEACHING ASSISTANT

Ms. Jing Zhang, 338 Bell Hall

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Office hours: 3:00 PM-5:00 PM Wednesday

COURSE DESCRIPTION

This course provides an overview of modeling techniques and methods used in decision analysis, including multiattribute utility models, decision trees, and Bayesian models. Psychological components of decision making are discussed. Elicitation techniques for model building are emphasized. Practical applications through real-world model building are described and conducted, including business management, supply chain and logistics, transportation, health care, and homeland security. Each group, which consists 1-3 students, will work on a project throughout the semester, including oral presentations and written reports.

Prerequisites: EAS 305 Applied Probability & Statistics Inference; or Graduate student status.

What You Can Get out of This Course: The ability to make good decisions is a fundamental skill for engineers and managers in any organization. This course will teach the skills and concepts that you need to make better decisions. The ideas will be applicable in your personal life as well as your professional life. We will learn quantitative techniques for identifying good decisions in complex situations, but also general concepts that can help you even if you don't use those quantitative techniques. These ideas can help you deal with many of the things that can make decision-making difficult, such as uncertainty about future outcomes, tradeoffs between competing objectives ("comparing apples and oranges"), and nonlinearity of preferences (e.g., the fact that twice as much of something may not be twice as good).

Student Learning Outcomes: After successfully completing this course, you should be able to:

- * Recognize the types of problems that decision analysis can and can't address.
- * Identify the values, objectives, attributes, decisions, uncertainties, consequences, and trade-offs in a real decision problem.
- * Apply the concepts learned in this class (expected value, value of information, risk aversion, and tradeoffs between attributes) to identify good decisions and strategies.

- ★ Represent a decision problem graphically and mathematically.
- ★ Determine the optimal decision mathematically.
- ★ Identify which parameters have the most impact on the results of an analysis.
- ★ Explain the results of a decision analysis to managers and other non-specialists.

Computing: In this course, we will make extensive use of software, such as the DecisionTools[®] Suite software accompanied with the textbook, and Microsoft Office (Word, Excel, and Powerpoint).

REFERENCES

The two textbooks for the course are as follows.

- ★ *Making Hard Decisions with DecisionTools[®]*, By Robert T. Clemen and Terence Reilly, Cengage Learning, 3rd edition (updated May 13, 2013). ISBN-10: 128540307X; ISBN-13: 9781285403076.
- ★ *Smart Choices: A Practical Guide to Making Better Decisions*, By John S. Hammond, Ralph L. Keeney, and Howard Raiffa, New York, NY: Broadway Books, 2002. ISBN: 978-0875848570.

Both of these books are extremely readable, and in fact even interesting and enjoyable to read (at least in my opinion). Therefore, unlike in some classes (where you might use the textbook only to look up the homework problems, and review any formulas or equations used in the homework), I would encourage you to read the books and keep up with the material being covered in class. This will help you understand the material in more depth and see how the ideas we are studying apply to daily life, and in general will give you different perspectives on the material we are studying, in addition to just my viewpoint.

COURSE GRADING

To qualify for a particular letter grade, the minimum course average shown after that grade will be needed: A (90); A- (86); B+ (82); B (78); B- (74); C+ (70); C (66); C- (62); D+ (58); D (54); and F (less than 54). I reserve the right to lower these cutoffs (i.e., give higher grades than indicated) under some circumstances (e.g., if one of the exams turns out much too difficult). However, I will not raise the cutoffs. I also follow the University's policy on Explanation of Grades, including the incomplete grades; see <http://undergrad-catalog.buffalo.edu/policies/grading/explanation.shtml>.

Item	Percentage
Homework	30%
First mid-term exam	20%
Second mid-term exam	20%
Project written proposal	5%
Project oral proposal presentation	5%
Project oral final presentation	5%
Project written final report	15%

Homework: Homework will be assigned in many weeks. It will generally be handed out on a Wednesday, due the following Wednesday, and returned to you by the Wednesday after that. Homework must be turned in by the end of the class period in which it is due. Provide your full name and student ID number for each of the homework that you submit. Late homework will not be accepted, except in extenuating circumstances (e.g., family emergency, illness), with official documents and instructor/TAs' permission. You are encouraged to join with other students in discussing the course, including homework. This is especially useful if you have first tried to solve the problem on your own, and focus on understanding the reasons for any differences between your answer and someone else's approach, rather than just copying the answer that someone else got. Note, however, that when you write up the work that you hand in, you should do

so on your own. You are strongly recommended to turn in a computer-generated (e.g., L^AT_EX, MS Word) homework if possible.

Exams: There will be two mid-term exams and no final one. Exams will be held during class-time. Those exams will be closed book and closed notes. However, you are allowed to bring one double-sided US Letter size formula sheet for each of the exams. Makeup exams will be administered only under extenuating circumstances with official documents, provided that I am notified in advance.

Project: Each group (1-3 students) works on a project. Project is an essential part for this class, which consists of four parts: written proposal (2-3 pages, single spacing with 12pt fonts), oral proposal presentation (~ 2 minutes), oral final-term presentation (~ 7 minutes), and written final report (15-20 pages, single spacing with 12pt fonts). Students are strongly encouraged to discuss with Dr. Zhuang and/or their own research advisors to find a suitable project/research/thesis topic related to decision analysis. Each group is required to discuss with and get a permission from the Dr. Zhuang, regarding the detailed project topics and plans, in email, office hours or by appointments by September 15, 2017. Projects could be based on the research which has been initiated before, in which cases the students must clearly document which parts have already been done and which parts are additional progress for this course project, in all presentations and reports. The written proposal is due by September 22, 2017; and the written final report is due by December 8, 2017. Both presentations will be scheduled in class and evaluated by both students and the instructor. Project gradings will be based on the (oral and written) presentation skills, the quality of the (new) research, and the probability of eventually getting published in a scholarly journal.

Attendance: Although positively correlate with your homework and exam grades, attendance at the lectures will not be directly included in your final grade. However, attendance is fundamental to the course, so if you do not come to class, you are giving yourself a disadvantage. Absenteeism can also be a sign of illness or other serious problems; don't hesitate to email or stop by to discuss the reasons for any absences. If you need help, please let me know, and I will try to connect you with the appropriate campus resources.

OFFICE HOURS

To be fair to all of the students and to the colleagues that we work with, please cooperate with us in respecting the office hours of the TA and the professor. However, individual appointments can be made, if the posted office hours are insufficient or inconvenient. You may email the instructor or TA at any time to discuss your questions by email, or to set up an appointment. I will respond as soon as possible, but you should be aware that I do not always check my email on the evenings and weekends, or when I am traveling.

UNIVERSITY POLICY ON ACADEMIC INTEGRITY

All work must be your own. Plagiarism is never allowed. If any student is found in violation of maintaining academic integrity, sanctions will be imposed. This can be as severe as receiving an 'F' in the course. Especially flagrant violations will be considered under formal review proceedings, which can call for harsher sanctions including expulsion from the University. All students are expected to be familiar with and abide by the University's academic integrity policies, available in the Undergraduate Catalog: <http://undergrad-catalog.buffalo.edu/policies/course/integrity.shtml> or the Graduate School Policies and Procedures Manual: <http://www.grad.buffalo.edu/policies/academicintegrity.php>. Plagiarism detection software may be used by individual instructors or the institution to aid in determining the originality of student work. If you ever have any questions or concerns regarding the policy, particularly as it related to this course, see the instructor.

ACCESSIBILITY RESOURCES

If you require classroom or testing accommodations due to a disability, please contact the University's Accessibility Resources Office <http://www.student-affairs.buffalo.edu/ods/>, located at 25 Capen Hall. AR can be reached by phone at (716) 645-2608 or by email at stu-accessibility@buffalo.edu. Please inform me as soon as possible about your needs so that we can coordinate your accommodations.

PROFESSIONALISM

Students are expected to use professional style throughout the class and in all communications, including emails to faculty and teaching assistants/graders. This includes the use of salutations and closings (including clear identification of the author) and correct grammar. Students are expected to refrain from use of cell phones or other electronic devices unless they are clearly linked to class purposes (e.g., note-taking). Cell phones must remain off or muted. We reserve the rights of increasing the grades by up to 4% for students demonstrating great professionalism.

COURSE OUTLINE ****This outline is subject to change****

Week	Date	Course Material	Note
No. 1	09/01	Introduction and elements of decision problems (CR 1-2; HKR 1-4) Probabilistic modeling (HKR 7)	First day of class
No. 2	09/8	Decision trees (CR 3) Multi-stage decision trees (HKR 9)	
No. 3	09/15	Rolling back decision trees, expected value of information (CR 12)	Topic to be Approved
No. 4	09/22	Influence diagrams (CR 3) Sensitivity analysis (CR 5)	Written Proposal Due
No. 5	09/29	Project oral proposal presentation Review of probability, Bayes theorem (CR 7; CR 9; CR 10)	Oral Presentation
No. 6	10/06	Decision traps: Cognitive biases in estimating probabilities (CR 8; HKR 10) Review for Mid-term Exam 1	Review for Exam 1
No. 7	10/13	Mid-term Exam 1 Structuring outcomes/objectives (CR 3; HKR 5)	Mid-term Exam 1
No. 8	10/20	Value functions, decisions under certainty (HKR 5) One-dimensional utility theory (CR 14; HKR 8)	
No. 9	10/27	Multi-dimensional utility theory: Comparing apples vs. oranges (CR 16-17) Decision traps: Cognitive biases in assessing preferences (CR 15; HKR 10)	
No. 10	11/03	Implementation and applications (HKR 11) Game Theory I	
No. 11	11/10	Game Theory II Advanced topic of Decision Analysis	
No. 12	11/17	Review for Mid-term Exam 2 Mid-term Exam 2	Exam 2
No. 13	11/24	No Class	Thanksgiving
No. 14	12/01	Project oral final presentation I	
No. 15	12/08	Project oral final presentation II Conclusion	Final Report Due