

Decision Analysis, ISE 562

Course ID's: Blackboard 20223_ise_562_mm-sj: Decision Analysis (31562,31548,31728)
(Tuesday Thursday + DEN)
Fall 2023 Course Syllabus
Dr. Smith

Contents

Contact Info
My Office Hours
Importance of this course
Course Description
Suggestions for success
Course Prerequisite
Course Goals
Text
Course Requirements and Grading
Schedule
Academic Integrity
Disability Accommodation
Emergency Preparedness

Contact Info: Value and Decision Analysis, ISE 562

Dr. Jeffrey H. Smith

Office Hours: Tuesday/Thursday 2-3:30p, after class, zoom appointment, or email.
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TA's

Tuesday/Thursday 12p+DEN Class TA: Ibrahim Raji
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Location: TBD
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Tuesday/Thursday 4p Class TA: Jing Sun
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Importance of this course:

As the dramatic consequences of engineering and business decisions (both good and bad) demonstrate the power to generate vast wealth or drive prosperous corporations into bankruptcy, decision making under risk and uncertainty is a crucial skill. It has become a cornerstone of modern data analytics for mining, processing, and extracting knowledge. This course is designed to enable the student to formulate, collect, analyze, frame, and interpret decision making information for selecting the "best" alternative action.

Course Description

The course is presented in 4 phases. The first phase presents a classical Bayesian decision approach and the components of decision making; the second phase explores the Keeney-Raiffa multiattribute (utility) decision analysis methodology; the third phase examines group decision making; and the fourth phase examines behavioral issues of decision making (e.g., framing and biases). The topics are summarized below.

| | |
|---|---|
| Chapter 1,2, Probability Review | Basic concepts, definitions of probability |
| Chapter 3, Discrete Bayes Methods | Decision making distributions for discrete random variables |
| Chapter 4, Continuous Bayes Methods | Decision making distributions for continuous random variables |
| Chapter 5, Decision Theory, Introduction to Utility Functions | Structuring decision problems |
| Chapter 6, Value of Information | EVPI, EVSI |
| Multiattribute decision analysis | Multiple decision variables |
| Group decision making | Group decision rules |
| Decision biases | Psychological and behavioral decision issues; framing |

Suggestions (for success)

You should read over the reading assignments before the corresponding lecture.
You should attempt the homework (at least once) on your own before asking for help.
Make an honest attempt to understand the material before uttering the words, "I don't get this."

Course Prerequisite Knowledge

ISE 220, 225, Calculus.

Course Goals

Students will learn:

- tools and techniques of decision theory for single, multiple attributes, behavioral problems
- how and when to apply the tools
- practice application of the tools with homework exercises

Text

Winkler, Robert L., An Introduction to Bayesian Inference and Decision, Second Edition, Probabilistic Publishing, Inc., Gainesville, Florida, 2003.

Course Requirements and Grades

The course requirements are as follows:

| Requirement | Point Total |
|------------------------------------|-------------|
| 3 Homework assignments @ 10 points | 30 |
| Midterm Exam | 25 |
| Project* | 20 |
| Final Exam | 25 |
| Course Total | 100 |

Submit assignments to ise562hwTues@gmail.com for Tuesday section and ise562hw@gmail.com for Wednesday sections.

The project will be announced after submission of homework assignment 2 and will be graded according to attributes of creativity, relevance, content, organization, and timeliness (4 pts each). All grading issues are closed after 2 weeks from the original due date. Late homework—40% off per day.

Schedule (Note: homework due on date shown.)

| Date | Topic | Readings | Assignments/Notes |
|----------------|---|--------------|-------------------|
| Tue. August 22 | Introduction, Review | Chapter 1, 2 | |
| Thu. Aug. 24 | Review | Chapter 2 | |
| Tue. Aug. 29 | Discrete Bayes Methods | Chapter 3 | |
| Thu. Aug. 31 | Discrete Bayes Methods | Chapter 3 | |
| Tue. Sept 5 | Continuous Bayes Methods | 4.1- 4.9 | |
| Thu. Sept 7 | Continuous Bayes Methods | 4.1- 4.9 | |
| Tue. Sept 12 | Decision making criteria | 5.1 - 5.4 | |
| Thu. Sept 14 | Utility concepts | 5.5 - 5.8 | |
| Tue. Sept 19 | Utility concepts | 5.5 - 5.8 | |
| Thu. Sept 21 | The Decision Problem | 5.9 - 5.10 | HW1 due |
| Tue. Sept 26 | The Decision Problem | 5.9 - 5.10 | |
| Thu. Sept 28 | Midterm review | | |
| Tue. Oct 3 | Midterm | | |
| Thu. Oct 5 | Value of Perfect Information | 6.1 - 6.2 | |
| Tue. Oct 10 | Value of Perfect Information | 6.1 - 6.2 | |
| Thu. Oct 12 | Value of Sample Information | 6.3 | |
| Tue. Oct 17 | Value of Sample Information | 6.3 | |
| Thu. Oct 19 | Multiattribute Decision Problems | Notes | |
| Tue. Oct 24 | Multiattribute Decision Models | Notes | HW2 due |
| Thu. Oct 26 | Multiattribute Decision Analysis under uncertainty | Notes | |
| Tue. Oct. 31 | Comparing decision models | Notes | |
| Thu. Nov. 3 | Practical guide for gathering decision data inputs | Notes | |
| Tue. Nov. 7 | Group Decision Making | Notes | |
| Thu. Nov. 9 | Group Decision Making | Notes | |
| Tue. Nov. 14 | Group Decision Making | Notes | |
| Thu. Nov. 16 | Decision making biases | Notes | |
| Tue. Nov. 21 | Decision making biases | Notes | HW 3 due |
| Thu. Nov. 23 | No Class—Thanksgiving recess | | |
| Tue. Nov 28 | Improving decision making | Notes | |
| Thu. Nov 30 | Improving decision making: Last class | Notes | Project due |
| Friday Dec 13 | Final Exam, 12p class: Dec 12, 11-1 pm. 4p class: Dec. 7, 4:30-6:30p | Location TBD | |

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations is from DSP. Please be sure I receive the letter as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Tuesday through Friday. Website and contact information for DSP:

http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html, (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) ability@usc.edu.

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards”

policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Student Health Counseling Services - (213) 740-7711 – 24/7 on call

engemannshc.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call

suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call

engemannshc.usc.edu/rsvp

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086

equity.usc.edu, titleix.usc.edu

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support - (213) 740-2421

studentaffairs.usc.edu/bias-assessment-response-support

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs - (213) 740-0776

dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710

studentaffairs.usc.edu/ssa

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu

Non-emergency assistance or information.

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies. Please activate your course in Blackboard with access to the course syllabus. Whether or not you use Blackboard regularly, these preparations will be crucial in an emergency. USC's Blackboard learning management system and support information is available at blackboard.usc.edu.