

Term Information

Effective Term Autumn 2014

General Information

Course Bulletin Listing/Subject Area Statistics
Fiscal Unit/Academic Org Statistics - D0694
College/Academic Group Arts and Sciences
Level/Career Undergraduate
Course Number/Catalog 3303
Course Title Bayesian Analysis and Statistical Decision Making
Transcript Abbreviation Stat. Dec. Making
Course Description Introduction to concepts and methods for making decisions in the presence of uncertainty. Topics include: formulation of decision problems and quantification of their components; learning about unknown features of a decision problem based on data via Bayesian analysis; characterizing and finding optimal decisions. Techniques and computational methods for practical implementation are presented.
Semester Credit Hours/Units Fixed: 3

Offering Information

Length Of Course 14 Week
Flexibly Scheduled Course Never
Does any section of this course have a distance education component? No
Grading Basis Letter Grade
Repeatable No
Course Components Lecture
Grade Roster Component Lecture
Credit Available by Exam No
Admission Condition Course No
Off Campus Never
Campus of Offering Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites Stat 3202
Exclusions

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code 27.0501
Subsidy Level Baccalaureate Course
Intended Rank Junior, Senior

Requirement/Elective Designation

Required for this unit's degrees, majors, and/or minors

Course Details

Course goals or learning objectives/outcomes

- Formulate the inputs to a decision problem including potential actions, losses and gains, and quantification of uncertainty.
- Process data and information regarding unknowns and apply computational procedures to reach optimal decisions based on that information.
- Assess the impacts of departures from your assumptions and produce actions that are robust or insensitive to those departures.
- Explain your analyses to others, such as managers and other decision makers.

Content Topic List

- Elements of decision problems
- modeling uncertainty
- formulating decision problems
- loss functions
- risk
- statistical decision making
- Bayesian analysis
- Monte Carlo simulation
- robustness and sensitivity

Attachments

- 3303_Syllabus.pdf

(Syllabus. Owner: Hans,Christopher M)

Comments

- This is a required course for the proposed major in Data Analytics. (by Craigmile,Peter F on 10/11/2013 03:17 PM)

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Hans,Christopher M	10/09/2013 02:51 PM	Submitted for Approval
Approved	Craigmile,Peter F	10/13/2013 06:08 PM	Unit Approval
Approved	Hadad,Christopher Martin	10/14/2013 06:49 AM	College Approval
Pending Approval	Vankeerbergen,Bernadette Chantal Nolen,Dawn Jenkins,Mary Ellen Bigler Hogle,Danielle Nicole Hanlin,Deborah Kay	10/14/2013 06:49 AM	ASCCAO Approval

Statistics 3303

Bayesian Analysis and Statistical Decision Making

3-semester-hour course

Prerequisite: Stat 3202 (Introduction to Statistical Inference for Data Analytics)

Exclusions:

Class distribution: Three 55-minute lectures

Course Description and Learning Outcomes

This course is an introduction to the concepts and methods for making decisions in the presence of uncertainty. The first topic is the formulation of decision problems and the quantification of their components. The course then focuses on learning about unknown features of a decision problem based on data via Bayesian analysis. It then turns to characterizing and finding optimal decisions. Techniques and approaches, including computational methods, needed for practical implementation of the theory are presented. The course concludes with reviews and simple examples of selected advanced topics. Throughout the course, the emphasis is on the practice of decision making and hence describes case studies and provides students opportunities to implement the theory.

Upon successful completion of the course, students will be able to

1. Formulate the inputs to a decision problem including potential actions, losses and gains, and quantification of uncertainty.
2. Process data and information regarding unknowns and apply computational procedures to reach optimal decisions based on that information.
3. Assess the impacts of departures from your assumptions and produce actions that are robust or insensitive to those departures.
4. Explain your analyses to others, such as managers and other decision makers.

Required Text and Other Course Materials

The required textbook for the course is *Making Hard Decisions*, 3rd Edition by Robert Clemen and Terence Reilly. The book is available for purchase at the official University bookstore (ohiostate.bkstore.com) and elsewhere online. The book is available on reserve in the 18th Avenue Library.

Assignments

Homework will be assigned (approximately) weekly, will be due on the dates announced in class and will be graded. Assignments will consist of a mix of several

problems selected from the textbook, problems motivated by data analytics applications, and small computer simulation problems.

A final project will be assigned midway through the semester and will be due at the end of the semester.

Exams

There will be two in-class midterms that cover material from lecture, the assigned readings and homework.

A cumulative final examination will be given during the university's examination period.

Grading Information

The final course grade will be based on homework assignments, projects, two midterms and a comprehensive final examination. The weights for each component of the grade are:

Homework	Project	Midterm 1	Midterm 2	Final Exam
20%	20%	20%	20%	20%

Outline of topics

1. Introduction to decision analysis
 - a. Basic elements: actions, losses and gains
 - b. Treatment of uncertainty: probabilities of unknowns
 - c. Risk and optimality
2. Modeling uncertainty
 - a. Review of probability, expectation
 - b. Conditional probability and conditional expectation
 - c. Learning from data: Bayes' Theorem
3. Formulating decision problems
 - a. Influence diagrams, decision trees
 - b. Developing loss functions
 - i. Utility theory
 - ii. Value of money
 - c. Developing prior distributions
 - i. Subjective probability

- ii. Common classes of priors
- 4. Statistical decision making
 - a. Use of data: posterior distributions
 - b. Risk analysis: posterior expected loss versus Bayes risk
 - c. Finding optimal Bayes actions; computation over decision trees
- 5. Implementing the theory
 - a. Computational approaches to developing posterior distributions
 - b. Use of simulation and Monte Carlo
 - c. Robustness and sensitivity analysis
 - d. Introduction to sequential decision making and experimental design
 - i. Value of information
 - ii. Cost of experiments
- 6. Introduction to advanced concepts
 - i. Group decision making
 - ii. Competitive games

Statement on Academic Misconduct

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc/>.

Special Accommodations

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; <http://www.ods.ohio-state.edu/>.