Term Information

Effective Term	Autumn 2014

General Information

Course Bulletin Listing/Subject Area	Psychology
Fiscal Unit/Academic Org	Psychology - D0766
College/Academic Group	Arts and Sciences
Level/Career	Graduate
Course Number/Catalog	6820
Course Title	Introduction to Bayesian Statistics for Psychological Data
Transcript Abbreviation	Bayes Stat For Psy
Course Description	An introduction to Bayesian statistics & data analysis for graduate students in the Dept of Psychology. It reviews basic probability theory & Bayes theorem, provides a broad introduction to inference from the modern Bayesian perspective & contrasts that to more traditional frequentist inference. Topics covered include analysis of proportions & means, interval estimates, regression, & Bayes factors
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 7 Week, 4 Week (May Session)
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	Prerequisite: Psych 6810 (828)
Exclusions	

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	42.0101
Subsidy Level	Doctoral Course
Intended Rank	Masters, Doctoral

Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- Students will learn the most common discrete and continuous probability distributions used in Bayesian inference
- Students will learn the distinction between frequentist and Bayesian statistics
- Students will learn how to construct simple models for Bayesian inference on proportions, means and regression
- Students will learn how to choose appropriate priors for different simple data models
- Students will learn how to evaluate statistical hypotheses using the Bayesian posterior
- Students will learn how to choose between different models for a data set

Content Topic List

- Probability distributions
- Bayes' Theorem
- Modeling proportional data
- The Normal mean
- Regression
- Model evaluation and comparison

Attachments

- Psych 6820 syllabus.pdf: syllabus

  (Syllabus. Owner: Paulsen,Alisa Marie)
- concurrence_intro_bayes_psychology 6820.pdf: concurrence

  (Concurrence. Owner: Paulsen,Alisa Marie)

Comments

- We feel that with the title, course description, and syllabus, the intent that the course is specifically for psychology graduate students is clear. *(by Paulsen,Alisa Marie on 10/31/2013 02:53 PM)*
- The Stats concurrence is subject to the course being open only to Psych students. The syllabus implies as much in that it requires a student's own Psych data. Do you feel this is sufficient or had you meant also to add Psych-only to the prereqs? *(by Haddad,Deborah Moore on 10/30/2013 11:19 AM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Paulsen,Alisa Marie	10/28/2013 05:43 PM	Submitted for Approval
Approved	Vasey,Michael William	10/30/2013 10:49 AM	Unit Approval
Revision Requested	Haddad,Deborah Moore	10/30/2013 11:19 AM	College Approval
Submitted	Paulsen,Alisa Marie	10/31/2013 02:53 PM	Submitted for Approval
Approved	Vasey,Michael William	10/31/2013 03:08 PM	Unit Approval
Approved	Haddad,Deborah Moore	10/31/2013 04:04 PM	College Approval
Pending Approval	Vankeerbergen,Bernadette Chantal Nolen,Dawn Jenkins,Mary Ellen Bigler Hogle,Danielle Nicole Hanlin,Deborah Kay	10/31/2013 04:04 PM	ASCCAO Approval

Psychology 6820
Introduction to Bayesian Statistics for Psychological Data

Lecture:	MWF for 50 minutes or TTh for 1:20 minutes
Instructor:	Trisha Van Zandt Lazenby 230, 688-4081 Office hours: TBA, or by appointment E-mail: van-zandt.2@osu.edu
Web site:	This course will use Carmen. Electronic communications via Carmen use your OSU handle (e.g., "smith.9999@osu.edu"). Make sure you check your OSU email on a regular basis.
Text:	Bolstad, W.M. (2007). *Introduction to Bayesian Statistics* (2^{nd} Edition) Hoboken, NJ: John Wiley & Sons.
Software:	1. R (free download for all platforms) with the "Bolstad" library (see Appendix D, p. 387). 2. OpenBUGS or JAGS (free downloads).

Students with Disabilities

This syllabus is available in alternative formats upon request. In addition, if you may need an accommodation based on the impact of a disability, you should contact the instructor immediately. Students with special needs should contact the Office of Disability Services (ODS) at 292-3307, TDD 292-0901, for certification if they have not already done so. Upon such certification, the ODS and the instructor will make every effort to accommodate special needs. However, to ensure that evaluation of student performance in the course is conducted in a manner that is fair to all students, special accommodations will not be granted in the absence of ODS certification.

Academic Misconduct

All students at the Ohio State University are bound by the Code of Student Conduct (see http://studentaffairs.osu.edu/resource_csc.asp) and are responsible for familiarizing themselves with the Code. In particular, Rule 3335-23-04 (Prohibited conduct), Section A, defines academic misconduct. Suspected violations of the code in this class will be dealt with according to the procedures detailed in that code. Any alleged cases of misconduct will be referred to the Committee on Academic Misconduct.

Specifically, the use of unauthorized materials during exams, the use of unauthorized assistance on a graded assignment, unauthorized collaboration such as working together on homeworks or sharing files, falsification of documents, serving as or enlisting the assistance of a substitute for an exam or graded assignment, or violation of course rules as contained in this syllabus, in addition to the other prohibited conducts described in Rule 3335-23-04 Section A, constitute academic misconduct.

If you have a question about whether or not an activity is or could be perceived to be academic misconduct, for this or any other class, please ask the instructor.

All graded assignments in this course should be completed by you alone and not by or in collaboration with anyone else.

Course Description and Objectives

Over the past several decades, modern statistical analysis has moved steadily away from the traditional frequentist approach taught in introductory-level statistics courses and toward Bayesian analysis. The reasons for this are manifold, and include the wide availability of powerful desktop computers and software that makes Bayesian statistics possible for everyone. The driving force behind this shift, however, is the fact that Bayesian statistics are more desireable than frequentist null hypothesis tests for a number of reasons. First, the idea that our prior expectations about the outcome of an experiment can play a role in our analyses embodies the cumulative nature of the scientific enterprise. Second, the treatment of parameters as subject to randomness is more realistic than the fixed parameters of frequentist null hypothesis testing. Third, the Bayesian analysis is based on a model of the data specified *a priori*, and therefore does not require the analyst to rely on models that are known to be false or true only "in the limit," when the sample of data becomes infinitely large. Fourth, the questions we can answer using Bayesian statistics are those of most scientific interest, and are of the form "What can I conclude about the hypothetical process that produced the data I observed?" in contrast to the confusing, less useful and philosophically problematic questions answered by null hypothesis testing: "What is the probability of getting the measurement that I obtained if I assume that changes in my independent variable had no effect?" There are many other reasons to perform Bayesian statistics, but I will stop here.

Bayesian statistics can be mastered by students with modest mathematical and statistical backgrounds. Therefore it is particularly troublesome that, at this time, introductory statistics classes focus almost exclusively on frequentist methods. This class is designed to introduce basic Bayesian ideas to psychologists trained in frequentist methods. At the end of this class, you will have learned:

- The most common discrete and continuous probability distributions used in Bayesian inference;
- The distinction between frequentist and Bayesian statistics;
- How to construct simple models for Bayesian inference on proportions, means and regression;
- How to choose appropriate priors for different simple data models;
- How to evaluate statistical hypotheses using the Bayesian posterior; and
- How to choose between different models for a data set,

among other things.

Grades

This course will use the following fixed grading scale:

A	A-	B+	B	B-	C+	C	C-	D+	D
93%	90%	87%	83%	80%	77%	73%	70%	67%	60%

There will be three exams, each worth 15% of your grade. Homework exercises will be worth 35% of your grade, and a final project will be worth 20% of your grade.

Important Dates

	Date	Weight
Midterm 1	TBA	15%
Midterm 2	TBA	15%
Midterm 3	TBA	15%
Final Project due	Last day of class	20%
Homework	due weekly	35%
Total		100%

I reserve the right to modify the weights on exams and homeworks as I see appropriate. I also reserve the right to give unannounced or "pop" quizzes, either for extra credit or otherwise. *Extra credit cannot be used to raise a failing grade (E) to a passing grade (D or better). Extra credit will only be applied to final grades of D or better.*

The Curve

To prevent against unfair exams, the grade of the second highest scorer on any exam will be 100%, and the cutoffs will be computed from that grade. So, for example, if I write a really hard test and the second highest score is 72%, and you earn 60%, your score on that exam will be $60/72 = 83\%$.

Homework

Homework includes both your daily reading assignment and exercises from the book and given in class. The purpose of homework exercises is to give you the opportunity to practice performing computations and answering questions that will be similar to those that will be on the exam.

Homework from the book will be given every week, and answer keys to the homework will be posted on Carmen.

Exams

Exams will be closed-book, but you may bring one 8.5"x11" page of notes to the exam.

Please note carefully:

1. If, because of an emergency, you cannot take an exam at the scheduled time, you must contact me BEFORE the exam.
2. There will be NO EXCEPTIONS to (1.) above.
3. I have voice mail (688-4081) so you can leave me a message if I am not at my desk. Any message time-stamped before the beginning of the exam will satisfy Item 1 above.
4. You must provide DOCUMENTATION that verifies the emergency that prevented you from taking the exam at the scheduled time. No documentation, no makeup.

Final Project

The final project will be an analysis of data that you have collected, either in your laboratory or data you have obtained online. If you have difficulty finding an appropriate data set, please come to me for assistance.

You will perform an analysis of your data with respect to one of the models we have discussed in class. You will be required to hand in the following: 1) an electronic file containing your data (all identifying information must be removed if the data involve human subjects); 2) all your R code, with documentation, necessary to conduct the analyses; and 3) a 5-page writeup of your results.

More detailed information will be made available later in the semester.

Tentative Class Schedule (*Note Midterm Dates)

Week	Weekday	Bolstad	Topics
1	Monday	Ch 1-3	Introduction
	Wednesday	Ch 4	Probability review
	Friday		Joint and conditional probability
2	Monday		Bayes' Theorem
	Wednesday	Ch 5	Random variables
	Friday		Discrete distributions
3	Monday	Ch 6	Discrete priors and posteriors
	Wednesday		The binomial model
	Friday		The Poisson model
4	Monday	Ch 7	Continuous distributions I
	Wednesday		Continuous distributions II
	Friday	Ch 8	Binomial proportions
5	Monday		Beta-binomial model
	Wednesday		Credible intervals
	Friday*	Midterm 1 (Covers readings and lectures through Week 4)	
6	Monday	Ch 9	Bayesian vs. frequentist inferences
	Wednesday		Interval estimation
	Friday		One- and two-sided hypotheses
7	Monday	Ch 10	Poisson models
	Wednesday		Uniform prior
	Friday		Jeffreys' prior
8	Monday	Ch 11	Normal mean with a discrete prior
	Wednesday		Normal mean with a continuous prior
	Friday		Credible interval for the mean
9	Monday		The predictive density
	Wednesday	Ch 12	Bayesian vs. frequentist inference for the mean
	Friday	Ch 13	Differences between two means
10	Monday		Unequal variances
	Wednesday		Differences between proportions
	Friday*	Midterm 2 (Covers readings and lectures from Weeks 5 through Week 4-9)	
12	Monday	Ch 14	Simple regression model
	Wednesday		Bayes' Theorem for regression
	Friday		Prediction
13	Monday	Ch 15	Normal variance
	Wednesday		Priors and posteriors for the variance model
	Friday		Bayesian Inference for the variance
14	Monday	Ch 16	Misspecified priors
	Wednesday		Mixtures
	Friday		Multiple regression
(Extra)	Monday		Bayes factors
	Wednesday		Closing words, Final Project Due
	Friday		Catchup day
Finals Week	Midterm 3 (Covers readings and lectures from Weeks 10 through Week 15)		

Department of Statistics

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September 19, 2013

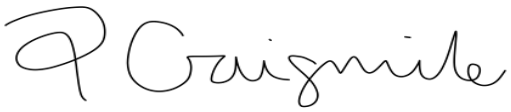
Department of Psychology
College of Arts and Sciences

Dear Prof. Trisha Van Zandt

The chair, curriculum committee, and a number of other faculty in the Department of Statistics have looked over your proposal for teaching an introductory course in Bayesian statistics to non-quantitative graduate students in the Department of Psychology. This letter gives our concurrence, subject to:

- The course being only open to Psychology students (with psychology course requirements);
- We suggest the addition of the word "Psychology" in the course title.

Sincerely,



Peter F. Craigmile, Ph.D.
Curriculum Chair, Department of Statistics.

cc: Mark Berliner, Chair, Department of Statistics