PSQF 7375: Bayesian Psychometric Modeling Syllabus; Fall 2022

*Note: The online syllabus at the address provided above will always have the most current information.*

## Course Information

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| Instructor: | Jonathan Templin |
| email: | [jonathan-templin@uiowa.edu](mailto:jonathan-templin@uiowa.edu) |
| Course website: | <https://jonathantemplin.com/bayesian-psychometric-modeling-fall-2022/> |
| Office: | S210B Lindquist Center |
| Office Phone: | 319-335-6429 |
| Classroom: | S302 Lindquist Center |
| Course Meeting Time: | W & F 12:30-13:45 |
| Course Office Hours: | Wednesdays 14:00-16:00 or by appointment |
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### Course Objectives, Materials, and Prerequesites

In this course a unified Bayesian modeling approach will be presented across traditionally separate families of psychometric models. Focusing more directly how to use Bayesian methods in psychometrics, this course will to cover Bayesian theory along with applied treatments of popular psychometric models, including confirmatory factor analysis (CFA), item response theory (IRT), latent class analysis, diagnostic classification models, and Bayesian networks. Time permitting, multilevel models and multilevel psychometric models will be presented.

## Tentative Course Schedule

* ☐ Add references for topics

| Date | Topic | References(s) |
| --- | --- | --- |
| 24 Aug | Course Introduction and Foundational Bayesian Concepts |  |
| 26 Aug | Introduction to Psychometric Modeling |  |
| 31 Aug | Bayesian Estimation and an introduction to MCMC |  |
| 2 Sep | Bayesian Confirmatory Factor Analysis |  |
| 7 Sep | Introduction to JAGS, Gibbs Sampling, and the Metropolis-Hastings Algorithm |  |
| 9 Sep | Bayesian Confirmatory Factor Analysis |  |
| 14 Sep | MCMC Convergence Diagnostics |  |
| 16 Sep | Bayesian Psychometric Model Fit Assessment |  |
| 21 Sep | Introduction to Stan and the Hamiltonian Monte Carlo Algorithm |  |
| 23 Sep | Bayesian Item Response Theory (Binary Item Models) |  |
| 28 Sep | Missing Data in MCMC Estimation |  |
| 30 Sep | Model Fit for Categorical Item Models |  |
| 5 Oct | Bayesian Item Response Theory (Graded Response Models) |  |
| 7 Oct | Bayesian Item Response Theory (Nominal Response Models) |  |
| 12 Oct | Class Via Video: Model fit with Nominal Item Models |  |
| 14 Oct | Class Via Video: Topics TBA |  |
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## Course Website/Technology

This course will not use ICON for lecture materials. Instead, we will use freely available commercial software for communication and dissemination of course materials. Course lecture slides, lecture examples, video files, assignments, and information are available on the website, <https://jonathantemplin.com/bayesian-psychometric-modeling-spring-2018/>.

All lectures will be streamed and archived on YouTube (my YouTube channel is <https://www.youtube.com/channel/UC6WctsOhVfGW1D9NZUH1xFg?view_as=subscriber>). ICON will be used for storing your individual grades only.

### Course Materials

All course materials will be based in R, R Notebooks, and R Markdown and will be available using the course Git repository at: <https://github.com/jonathantemplin/BayesianPsychometricModeling>. We will be using Git to enable each of us to make changes to documents whenever mistakes are made or whenever other materials may be needed.

Further, all homework assignments will be turned in as R Markdown documents, weaving text with analysis syntax. I am attempting to use GitHub Classroom to allow you to submit your materials that way.

### Statistical Computing

The course will use the R statistical package with the R Studio development suite along with a set of packages for using R with Non-R Bayesian Inference Software. Additionally, we will be using JAGS for all analyses. All assignments must be completed in R, using R Markdown. For all other specific information regarding general course policies, course evaluation rubrics, and grading systems, please see the course syllabus at the link below.

R, R Studio, and JAGS are available for free from the following websites: R: <http://www.r-project.org/> R Studio: <http://www.rstudio.com/> JAGS: <http://mcmc-jags.sourceforge.net> Git Client (for Windows; MacOS and Linux have one installed): <https://gitforwindows.org>

R and R Studio work with JAGS by using a series of downloadable packages. Further, additional R packages may be used within the course as needed.

## Course Structure and Student Evaluation

Student evaluation will be made based homework grades only. There will be at most seven homework assignments, with no less than two weeks time to submit answers. All homework and answers must be from each student’s own work and not be copied or paraphrased from anyone else’s answers. After each homework (but the last) has been graded, students can revise and resubmit their homework for a better grade. Homework revisions will have a unique deadline for submission. Each homework will be worth approximately 15 points, for 105 total points that can be earned.

### Course Grading System

| Point Total | Letter Grade |
| --- | --- |
| 100 and Above |  |
| 99-93 |  |
| 92-90 |  |
| 89-87 |  |
| 86-83 |  |
| 82-80 |  |
| 79-77 |  |
| 76-73 |  |
| 72-70 |  |
| 69-60 |  |
| Below 60 |  |
|  |  |

### Late Homework Assignments:

In order to be able to provide the entire class with prompt feedback, late homework assignments will incur a 5-point penalty. However, extensions may be granted as needed for extenuating circumstances (e.g., conferences, family obligations) if requested at least three weeks in advance of the due date.

### Planned Homework Assignments

| Homework | Topic | Date Assigned |
| --- | --- | --- |
| Homework 1 | R/RStudio/JAGS | Jan 18 |
| Homework 2 | Linear Models | Feb 1 |
| Homework 3 | CFA Models | Feb 15 |
| Homework 4 | IRT Models | Mar 1 |
| Homework 5 | MIRT Models | Mar 15 |
| Homework 6 | LCA Models | Apr 12 |
| Homework 7 | BINs | Apr 26 |
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## Additional Information

* Name of Department: Psychological and Quantitative Foundations
* Location of Departmental Office: 361 Lindwquist Center
* College policy on student complaints and dispute resolution: <https://education.uiowa.edu/services/office-dean/policies/student-complaint-procedure>
* Preferred Contact Information for the DEO: [saba-ali@uiowa.edu](mailto:saba-ali@uiowa.edu)
* College policy on student academic misconduct (plagiarism and cheating): <https://education.uiowa.edu/coe-policies/student-academic-misconduct>
* University Policy on Sexual Harassment: <http://opsmanual.uiowa.edu/community-policies/sexual-harassment>

## Students with Disabilities

I ask any students who are in need of any accomodations, have any emergency medical information of whichI should be aware, or need alternate arrangements in the event the building must be evacuated to schedule a meeting with me as soon as possible.

## Respect for Diversity

It is my intent that students from all diverse backgrounds and perspectives be well-served by this course, that students’ learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexual orientation, disability, age, socioeconomic status, ethnicity, race, culture, perspective, and other background characteristics. Your suggestions about how to improve the value of diversity in this course are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups.

In addition, in scheduling this course, I have attempted to avoid conflicts with major religious holidays. If, however, I have inadvertently scheduled a deadline that creates a conflict with your religious observances, please let me know as soon as possible so that we can make other arrangements.

=== # Unused old text

### Course Textbook

The course will follow the chapters of Bayesian Psychometric Modeling (2016) by Roy Levy and Bob Mislevy. The University of Iowa Library has electronic access to the book at <https://ebookcentral.proquest.com/lib/uiowa/detail.action?docID=4532358>.