PSQF 7375: Missing Data Methods Syllabus; Spring 2024

Version 1.0: 05 December, 2024

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

Course Information

Instructor:	Jonathan Templin
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Course website:	TBA
Course repo:	TBA
Course YouTube Playlist:	TBA
Office:	S300A Lindquist Center
Office Phone:	319-335-6429
Classroom:	S108 LC
Course Meeting Time:	W 12:30pm-3:20pm
Course Office Hours:	W 10:00am-12:00pm via Zoom at https://uiowa.zoom.us/my/jonathantemplinuiowa

Course Objectives, Materials, and Prerequesites

This course section explores missing data methods in applied statistics, data science, and psychometrics; emphasizing techniques such as multiple imputation, Bayesian methods, and maximum likelihood to handle and analyze incomplete datasets effectively.

Course Readings

The course will follow the chapters of Applied Missing Data Analysis (2nd Edition) by Craig Enders. The University of Iowa Library has electronic access to the book at https://ebookcentral-proquest-com.proxy.lib.uiowa.edu/lib/uiowa/detail.action?docID=7027149. Additional readings will be posted our course ICON site.

Tentative Course Schedule

Week	Date	Topic	Reading
1	22 Jan	Introduction to Class/Major Types of Missing Data	None
2	29 Jan	Introduction to Missing Data	Chapter 1
3	5 Feb	Maximum Likelihood Estimation	Chapter 2
4	12 Feb	Maximum Likelihood Estimation with Missing Data	Chapter 3
5	19 Feb	Bayesian Estimation	Chapter 4

Week	Date	Topic	Reading
6	26 Feb	Bayesian Estimation with Missing Data	Chapter 5
7	5 Mar	Bayesian Estimation for Categorical Variables	Chapter 6
8	12 Mar	Multiple Imputation	Chapter 7
9	19 Mar	Spring Break: No Class	No Readings
10	26 Mar	Multilevel Missing Data	Chapter 8
11	2 Apr	Missing Not at Random Processes	Chapter 9
12	9 Apr	Special Topics and Applications	Chapter 10
13	16 Apr	Guidance for Working with Missing Data	Chapter 11
14	23 Apr	Missing Data in Psychometric Models: Latent Variable Scores	Mislevy et al. (1992)
15	30 Apr	No Class: AERA/NCME Conference	
16	7 May	Missing Data in Psychometric Models: Implications for CAT	Doebler et al. (2013); Jewsbury et al. (2024);

Additional Readings

Mislevy, R. J., Beaton, A. E., Kaplan, B., & Sheehan, K. M. (1992). Estimating population characteristics from sparse matrix samples of item responses. Journal of Educational Measurement, 29(2), 133-161.

Jewsbury, P. A., Lu, R., & van Rijn, P. W. (2024). A general framework for modeling missing data due to item selection with item response theory. Methodology, 20(3), 218-237.

Doebler, A., Doebler, P., & Holling, H. (2013). Optimal and most exact confidence intervals for person parameters in item response theory models. Psychometrika, 78(1), 98-115.

Course Website/Technology

ICON *will* be used for grades, submission of assignments, disseminating course readings, and course communications.

ICON *will not* be used 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. Additionally, all course materials will be available using the course Git repository.

All lectures will be archived on YouTube (my YouTube channel is https://jonathantemplin.com/YouTube).

Statistical Computing

The course will use the R statistical package with the R Studio development suite along with a set of R packages (both Bayesian and Non-Bayesian). Additionally, we will use the JAGS and Stan open-source Bayesian estimation programs. R and R Studio work with JAGS and Stan by using a series of downloadable packages which will be used throughout the course.

R, R Studio, and stan are available for free from the following websites: R: https://www.r-project.org/ R Studio: https://www.rstudio.com/ Stan: https://mc-stan.org/ JAGS: https://mcmc-jags.sourceforge.io

The University of Iowa enables access for many of these programs through their research computing resources: R Studio Notebooks: https://notebooks.hpc.uiowa.edu/ High Performance Computing: https://hpc.uiowa.edu/

Although this software is available at the University of Iowa, I ask that you install all versions on your local computer as campus resources can be difficult to use for many analyses.

Homework, Formative Assessments, and Course Project

Student evaluation will be made based three components: (1) homework assignments (50% of course grade), (2) assigned reading assessments (20% of course grade), and (3) a final examination (30% of course grade).

Mathematically, the grade percentage can be expressed as:

$$GP = .5 \times HP + .2 \times ARP + .3 \times FP,$$

Where:

- GP is the Grade Percentage
- HP is the Homework Percentage
- ARP is the book Assessment Percentage
- FP is the Final Examination Percentage

Homework Assignments

There will be a set of homework assignments, the number to be determined. For each assignment, students will have a minimum of two weeks to complete the assignment. Homework assignments will weighted equally with respect to the 60%/ of the course grade accounted for by homework. The lowest homework percentage will be dropped (to allow for grace for late homework).

Mathematically, the homework percentage can be expressed as:

$$HP = \left[\frac{\left(\sum_{h=1}^{H} P_h \right) - \min_h P_h}{H - 1} \right],$$

where P_h is the percent correct on homework h, with H total homeworks.

In order to be able to provide the entire class with prompt feedback, late homework assignments will not be accepted. 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. Additionally, late homework due to emergencies will be accepted with documentation of the circumstances of the emergency.

All assignments must be completed in R, using R Markdown as a file format, and submitted via ICON. Although students are encouraged to work together on the concepts underlying homework, all answers must be from student's own work (writing and syntax) and not be copied or paraphrased from anyone else's answers. Grammar and writing will be assessed by each homework and will factor into the homework grade.

Assigned Reading Assessments

Each week, students will take a short assessment in ICON with questions pertaining to the reading assigned that week. The purpose of the assigned reading assessment is to ensure reading materials are read prior to class being held. Questions will be graded correct/incorrect.

Verbal Final Examination

As we live in the era of large language models, rather than a written project, students will be required to complete a verbal final examination. The verbal final examination will be a one-on-one meeting with the instructor. The verbal final examination will account for 30% of the course grade.

The contents of the final will be the entirety of the course materials, with an emphasis on the readings and the homework assignments. The verbal final examination will be held during finals week (Wednesday, May 14th) via Zoom. A sign-up sheet for an examination time blocks will be posted on ICON.

Course Grading System

Point Total	Letter Grade
100 and Above	A+
99-93	A
92-90	A-
89-87	B+
86-83	B
82-80	B-
79-77	C+
76-73	C
72-70	C-
69-60	D
Below 60	F

Use of Artificial Intelligence or Other Technology

This course assumes that work submitted by students—all process work, drafts, low-stakes writing, final versions, and all other submissions—will be generated by the students themselves, working individually. This means that the following would be considered violations of academic integrity: a student has another person/entity do the writing of any substantive portion of an assignment for them, which includes hiring a person or a company to write essays and drafts and/or other assignments, research-based or otherwise, and using artificial intelligence affordances like ChatGPT.

University of Iowa Course Policies and Resources for Students

- Student Complaint Procedure: https://education.uiowa.edu/faculty-and-staff-resources/student-complaint-procedure
- College policy on student academic misconduct: https://education.uiowa.edu/faculty-and-staff-resources/student-academic-misconduct
- University policies https://provost.uiowa.edu/student-course-policies