SYLLABUS: STAT 6520
APPLIED STATISTICAL ANALYSIS WITH MISSING DATA
AUTUMN 2021

Course overview

Instructor

Instructor: Dr. Elly Kaizar
Email address: kaizar.1@osu.edu
Phone number: 614-247-2585
Course website: https://osu.instructure.com/courses/108589
Office hours: Office Hours via Carmen Zoom: ***Wednesdays 4:10-5:05pm***, Eastern time, and by appointment (please email with your availability). My Zoom link will be posted on Carmen.
Office Location: 221 Cockins Hall

Prerequisites

STAT 6201, 6302 or 6802, and STAT 6450 or 6950, or permission of instructor.

Teaching Assistant

Lun Li will be helping grade this semester. He will not be holding office hours for this course.

Course description

This class will review statistical analysis for complete data and provide an introduction to the models and methods for the dataset with missing values. The course has a significant component of statistical computations dealing with missing data. It is intended for those who already have some experience with standard statistical methods for complete data and want to extend them to handle missing data in practice.

Course learning outcomes

By the end of this course, students should successfully be able to:
- Describe the missing data mechanism and underlying assumptions and identify different patterns of missing data
- Describe the difference in statistical analysis between the missing data problem and complete data problem (including weighted methods)
- Perform simple missing data analysis; describe its weakness
- Implement likelihood-based analysis with ignorable missing response; implement the EM algorithm with some statistical package
- Describe the principle of Bayesian analysis with missing data; implement multiple imputation with some statistical package
- Describe and implement missing data models in contingency tables
- Describe modern statistical methods to deal with non-ignorable missing data
- Implement and interpret statistical methods for missing data in a practical scenario.

How this online course works

Mode of delivery: This course is scheduled to be an in-person course, meeting on Mondays, Wednesdays and Fridays from 3:00-3:55pm. I intend to simulcast in-person lectures over Zoom, and provide access to Zoom recordings as the inevitably flawed technology permits. I cannot monitor Zoom chat while lecturing in person, and I expect that students will have a richer experience if they attend in person. Students are expected to attend and participate during lecture, though I will not take attendance. Class may be held synchronously over Zoom to prevent disruption of instruction due to illness or other unanticipated instructor absence. A limited number of hours throughout the semester (typically every other Friday) will be devoted to asynchronous project-based activities.

Pace of activities: This course is divided into **biweekly modules.** Two weeks of lectures culminate in an in-depth homework assignment. Instructions for and extra information about this assignment will be delivered asynchronously via materials and video recordings on the last Friday of the week.

Course materials

Required textbook

Statistical Analysis with Missing Data, Little and Rubin, 3rd edition, Wiley. The textbook is available via the Ohio State Library: https://library.ohio-state.edu/record=b8643360.

Optional references

- *Analysis of incomplete multivariate data,* Schafer, J.L. Chapman & Hall, London.
- *Applied Missing Data Analysis*, Enders, C.K. The Guilford Press.

Course technology

For help with your password, university e-mail, Carmen, or other university-related technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at https://ocio.osu.edu/help/hours, and support for urgent issues is available 24x7.

- **Self-Service and Chat support:** http://ocio.osu.edu/selfservice
- **Phone:** 614-688-HELP (4357)
- **Email:** 8help@osu.edu
- **TDD:** 614-688-8743

Technology skills needed for this course

- Basic computer and web-browsing skills
- Navigating Carmen (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings)

Required equipment

- Computer with high-speed internet connection and browser for which Carmen is fully functional and R is fully functional (see below) (https://support.sas.com/ondemand/caq_swe.html)
- Other: a mobile device (smartphone or tablet) to use for BuckeyePass authentication

Required software

- This class requires you to use the statistical software package called R (The R Project for Statistical Computing; http://www.r-project.org/). This software package is available as Free Software.
  - You can download R for Windows, Mac, and Linux, from the CRAN archive at https://cran.r-project.org.
  - An in-depth introduction to R is available at http://cran.r-project.org/doc/manuals/R-intro.pdf
  - Hands-on tutorials are available in the Swirl system, which you can learn about at http://swirlstats.com/. In particular, "R Programming: The basics of programming in R" is an appropriate first tutorial for students who have never used R.
- An easier to use interface to R is available in the software package RStudio. This package is available for Windows, Mac, and Linux and can be downloaded for free from http://rstudio.org. **Note that RStudio requires R to be installed.**
  - Microsoft Office 365 ProPlus All Ohio State students are now eligible for free Microsoft Office 365 ProPlus. Students are able to access Word, Excel, PowerPoint, and other programs, depending on platform. Full instructions for downloading and installation can be found https://ocio.osu.edu/kb04733.

Carmen access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions (go.osu.edu/add-device).
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the Duo Mobile application (go.osu.edu/install-duo) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357(HELP) and IT support staff will work out a solution with you.

Grading and faculty response

How your grade is calculated

Assignment or category	Percentage
Homework	35
Midterm Exam	35
Final Project	30
Total	100

See course schedule, below, for due dates

All grades will be stored in Carmen. Students are responsible for regularly checking the grade entries in Carmen. Any grade disputes should be emailed to the instructor within 7 days of the grade assignment.

Descriptions of major course assignments

Homework

There will be approximately 7 graded homework assignments. These should be electronically to the Carmen Dropbox. Unless otherwise indicated in the assignment, electronic submissions must be a single file in .pdf format. Your name should appear both in the file name and at the top of the first page.

You may work together in solving homework problems, but your submitted work must be your own. You may not copy any of your submission from another student, the text, or any other source without proper attribution (citation). Remember that your grade will be based on your work that you submit. Feel free to ask the instructor for help after your first attempt at any homework problem.

Midterm Exam

There will be one in-class exam. You may bring a calculator (not a cell phone or other communication device) to the exam. You may bring two 8.5x11 sheets of paper with your own notes on both sides. These sheets may be prepared any way you like, and will not be collected.

~~Working programs are often improved by talking to other programmers. In this class, you will talk to other programmers as a class or in small groups, using the Carmen discussion boards.~~

~~During the first part of the course, the instructor will post a discussion prompt each week. Each student is expected to post a message responding to that prompt either for the whole class or for their assigned group, as specified in the instructions. This post will be graded for completion (i.e., a reasonable answer will get full credit). For many assignments, there will be a follow-up prompt to consider and synthesize student responses. While students are encouraged to post responses to the follow-up prompt, these will not be graded.~~

~~During the second part of the course, students will work together in small groups to complete a project. Weekly group assignments will keep groups on track to complete the final report in a timely manner. Some weeks these assignments will require individual submissions; others will require group submissions. These submissions will be graded for completion (i.e., a reasonable submission will get full credit).~~

Final project

This course has a final project. (There is no final exam.) Details about the final project will be posted on Carmen. You will be given ample time in which to work in groups to complete the project.

Late assignments

Assignments are provided well in advance. Students should plan ahead, pay attention to planned SAS outages, prepare for internet slowness, and be sure to leave extra time to upload files. Assignments uploaded within 24 hours of the due date will be deducted 20%. Assignments uploaded 24 hours or more after the due date will receive a zero. If you experience an emergency or other unplaned circumstance that prevents your submitting an assignment on time, please contact the instructor as soon as possible.

Grading scale

93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70 –72.9: C-
67 –69.9: D+
60 –66.9: D
Below 60: E

Instructor feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call **614-688-HELP** at any time if you have a technical problem.)

Grading and feedback

For homework assignments, you can generally expect feedback within **10 days**.

E-mail

I plan to reply to e-mails within **48 hours on days when class is in session at the university**. Please do not try to contact me via Carmen messaging.

Other course policies

Discussion and communication guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. Informality (including an occasional emoticon) is fine for non-academic topics.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **Citing your sources**: When we have academic discussions, please cite your sources to back up what you say. (For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.)
- **Backing up your work**: Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

Student academic services

Student academic services offered on the OSU main campus
http://advising.osu.edu/welcome.shtml.

Student support services

Student support services offered on the OSU main campus http://ssc.osu.edu.

Academic integrity policy

Policies for this online course

- **Quizzes**: You must complete the quizzes yourself, without any external help or communication. You may refer to course materials (e.g., textbook and video) during the quiz.
- **Written assignments**: Your written assignments should be your own original work. In formal assignments, you should follow a standard reference style (e.g. APA or Chicago) to cite the ideas and words of your research sources. You are encouraged to ask a trusted person to proofread your assignments before you turn them in--but no one else should revise or rewrite your work.
- **Reusing past work**: In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on past research or revisit a topic you've explored in previous courses, please discuss the situation with me.
- **Falsifying research or results**: All research you will conduct in this course is intended to be a learning experience; you should never feel tempted to make your results or your library research look more successful than it was.

- **Collaboration and informal peer-review**: The course includes many opportunities for collaboration with your classmates. While study groups and peer-review of major written projects is encouraged, remember that comparing answers on an exam or assignment is not permitted. If you're unsure about a particular situation, please feel free just to ask ahead of time.
- **Group projects**: This course includes group projects, which can be stressful for students when it comes to dividing work, taking credit, and receiving grades and feedback. I have attempted to make the guidelines for group work as clear as possible for each activity and assignment, but please let me know if you have any questions.

Ohio State's academic integrity policy

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/.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct web page (go.osu.edu/coam)
- *Ten Suggestions for Preserving Academic Integrity (*go.osu.edu/ten-suggestions*)*

Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on title IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at http://titleix.osu.edu or by contacting the Ohio State Title IX Coordinator, Kellie Brennan, at titleix@osu.edu

Commitment to a diverse and inclusive learning environment

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Land Acknowledgement

We would like to acknowledge the land that The Ohio State University occupies is the ancestral and contemporary territory of the Shawnee, Potawatomi, Delaware, Miami, Peoria, Seneca, Wyandotte, Ojibwe and Cherokee peoples. Specifically, the university resides on land ceded in the 1795 Treaty of Greeneville and the forced removal of tribes through the Indian Removal Act of 1830. I/We want to honor the resiliency of these tribal nations and recognize the historical contexts that has and continues to affect the Indigenous peoples of this land.

More information on OSU's land acknowledgement can be found here: https://mcc.osu.edu/about-us/land-acknowledgement

Your mental health

As a student you may experience a range of issues that can cause barriers to learn, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. No matter where you are engaged in distance learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious or overwhelmed, on-demand resources are available at go.osu.edu/ccsondemand. You can reach an on-call counselor when CCS is closed at 614-

292-5766, and 24-hour emergency help is also available through the 24/7 National Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org. The Ohio State Wellness app is also a great resource available at go.osu.edu/wellnessapp.

Accessibility accommodations for students with disabilities

Requesting accommodations

The university strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. **SLDS contact information:** slds@osu.edu; 614-292-3307; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Canvas accessibility (go.osu.edu/canvas-accessibility)
- Streaming audio and video
- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)
- Collaborative course tools

Disclaimers

This syllabus should be taken as a fairly reliable guide for the course content. However, you cannot claim any rights from it and in particular we reserve the right to change due dates or the

methods of grading and/or assessment if necessary. Any changes will be communicated to you through official course announcements.

Video and audio recordings of class lectures including student participation will be part of the classroom activity. The video and audio recording is used for educational use/purposes and may be made available to all students presently enrolled in the course.

Course schedule (tentative)

See Carmen for updates and details on assignments.

Week	Dates	Topics, Readings	Readings
1	8/24-8/29	Review of Statistical Inference	Text 6.1.1, 6.1.2, 6.1.4, 6.1.5
2	8/30-9/5	Review, cont. and Intro to Missing Data	Casella and George, 1992 (doi:10.2307/2685208); Text 1.1-1.3
	9/8, 3:00pm	Homework 1 Due	
3	9/6-9/12 (M 9/6 Labor Day)	Intro to Missing Data, cont.	Text 1.1-1.4; Templ, Alfons and Filzmoser, 2012 (doi:10.1007/s11634-011-0102-y)
	9/13, 3:00pm	Homework 2 Due	
4	9/13-9/19	Bayesian Inference and Multiple Imputation	Text 10.1, 10.2, 6.1.3, 5.4
5	9/20-9/26	Multiple Imputation, cont.	Text 10.1, 10.2, 6.1.3, 5.4
	9/27, 3:00pm	Homework 3 Due	
6	9/27-10/3	Congeniality and MI Shortcuts	Text 5.4, 6.1.3, 10.2
7	10/4-10/10	MI Shortcuts, cont.	Text Sections 5.4, 6.1.3, 10.2, White, et al (2011) Andridge and Little (2010)
	10/11, 3:00pm	Homework 4 Due	
8	10/11-10/17 (R-F 10/14-15 Autumn Break)	Single Imputation	Text Chapter 4

9	10/18-10/24	Single Imputation, cont.	Text Chapter 5
	10/25, 3:00pm	Homework 5 Due	
10	10/25-10/31	Likelihood-Based Inference	Text 6.2-6.3, 7.1-7.4, 9.1
11	11/1-11/7	Likelihood-Based Inference, cont.	Text 8.1-8.4 (skim 9.2), 13.1-13.3
	11/8, 3:00pm	Homework 6 Due	
	11/12, 3:00pm	Exam	
12	11/8-11/14 (R 11/11 Veterans Day)	Complete Case, Available Case and Weighting	Text Chapter 3
13	11/15-11/21	Weighting, cont.	Text Chapter 3
	11/22, 3:00pm	Homework 7 Due	
14	11/22-11/28 (WRF Various Breaks)	Nonignorable Missing Data	Text 15.1, 15.2
15	11/29-12/5	Nonignorable Missing Data, cont.	Text 15.3, 15.4
16	12/6-12/8	Sensitivity Analyses	Text 15.1-15.4 and TBD
	12/10, 3:00pm	Final Project Due	