



SYLLABUS: STAT 5302

Intermediate Data Analysis II

Spring 2023 (full semester)

3 credit hours

(Last Edited Dec 8, 2022)

COURSE OVERVIEW

Instructor

Matthew Pratola

Email address: mpratola@stat.osu.edu

Lectures: MWF 55 min lectures (3:00-3:55pm).

Location:

See Zoom link in Carmen.

Office hours: M 4:30-5:30pm

Graduate teaching assistant

Sarah Balfour

Role: Grading homework assignments and answering questions about the homeworks.

Email address: balfour.11@buckeyemail.osu.edu

Office hours: Wednesdays 1:50-2:45pm at

See Zoom link in Carmen.

Prerequisites

5301, or permission of the instructor.

Course description

STAT 5302 is the second course in a two-semester sequence in Intermediate Data Analysis (5301-5302). We assume that students are familiar with organizing and summarizing data, the nature of relationships between variables, sampling distributions and the underlying rationale

for hypothesis tests and confidence intervals. We also assume that students are comfortable with a variety of models and inferential procedures. Specifically, the material in 5302 relies heavily on the additive model (see the early part of the text for a description of this model) and one-way ANOVA. The course will cover simple linear regression, multiple linear regression, and two-way (and multi-way) ANOVA. For each of the common statistical methods covered in the course, we will focus on generation of appropriate models for data, estimation of the model parameters and their inference, and model diagnostics. Applications of the methods will be illustrated with data analysis.

STAT 5302 is a GE Data Analysis course.

Course learning outcomes

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

- Identify an appropriate analysis for data collected in a study
- Carry out such an analysis
- Examine whether the assumptions behind the analysis are reasonable, and
- Recognize the strengths or weaknesses of the study based on how the data were collected.

GE Course Information

- This course satisfies the GE Data Analysis requirement
- The expected learning outcomes are:
 - ELO1: Students understand basic concepts of statistics and probability
 - ELO2: Students comprehend methods needed to analyze and critically evaluate statistical arguments, and
 - ELO3: Students recognize the importance of statistical ideas.
- These goals will be achieved by detailed study utilizing example data from a variety of scientific fields

COURSE MATERIALS AND TECHNOLOGIES

Textbooks

Required

- The Statistical Sleuth – A Course in methods of data analysis, 3rd Edition, by Ramsey and Schafer, Duxbury Press, 2012 (<http://www.statisticalsleuth.com>)

The textbook is on reserve in the Science and Engineering Library (SEL).

Course Delivery

The majority of the course will be delivered synchronously via CarmenZoom during our scheduled class meeting times. All lectures will be recorded and posted on Carmen by the end of the day of the class (there may be a delay if Carmen is slow in processing the uploaded recordings). The instructor may elect to asynchronously use pre-recorded videos in place of live zoom lectures for certain topics, which will be announced on the course website. A tentative schedule of the course can be found in this syllabus.

Please check the course webpage regularly for important announcements, homework assignments and solutions and data examples. The instructor will also hold virtual office hours.

Recommended/optional

- I will highlight other useful resources as the course progresses.

Necessary Software

- This class requires you to use the statistical software packages called R (The R Project for Statistical Computing; <http://www.r-project.org/>) and RStudio (<http://rstudio.org>). These software packages are available as Free Software. More details will be given in lectures.
- In this course, you will be required to do some basic statistical analyses on the computer using the statistical software package 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.**

GRADING AND FACULTY RESPONSE

CATEGORY	PERCENTAGE
Homework	30
Midterm	30
Comprehensive Final Exam	40
Total	100

Homeworks:

There will be approximately bi-weekly assignments. Homework problems and solutions will be posted on Carmen. No late homeworks will be accepted. Homework is due at the beginning of class, and should be submitted electronically by uploading a PDF file to Carmen.

Exams: The midterm is **tentatively** scheduled to be on **Friday, February 24th** during our regularly scheduled class time. The final exam has been scheduled by the registrar for **Friday, April 28th** from **4:00pm–5:45pm**.

No make-up exams will be given. The final exam will be cumulative, but will emphasize the more recent material. Exam rules will be announced in class. A basic calculator is allowed.

Instructor feedback and response time

- If you have questions about the lectures or notice any typos in the materials, please email the instructor. Barring unforeseen circumstances, I will reply to e-mails within 24 hours on school days.
- If you have questions about the grading of homework assignments, please email the teaching assistant directly.

COURSE SCHEDULE

Refer to the Carmen website for up-to-date assignment due dates.

Week	Dates	Topics
1	Jan 9 - 13	Simple linear regression; least squares regression estimation (SS 7.1 - 7.3)
-	Jan 16	MLK Day (no classes)
2	Jan 18 - 20	Inferential tools for simple linear regression models, interpretation after log transformation (SS 7.4)
3	Jan 23 - 27	Residual diagnostics, R-squared, Simple LR vs one-way ANOVA, Lack-of-fit test (SS 8)
4	Jan 30 – Feb 3	Multiple linear regression model, Power transformation, Creating explanatory variables (SS 9)
5	Feb 6 - 10	Interpretation of coefficients, Inference about regression coefficients (SS 9)
6	Feb 13 - 17	Linear combination of coefficients, Predictions
7	Feb 20 - 24	Testing a group of coefficients with F-test, Model comparison (SS 10) Midterm 1 (55 mins)
8	Feb 27 – Mar 3	Residual plots, Model refinement, Weighted least squares
9	Mar 6 - 10	Influential observations, Case-influence statistics (SS 11)
-	Mar 13 - 17	Spring Break (no classes)
10	Mar 20 - 24	Sequential methods for variable selection, Model selection criteria
11	Mar 27 - 31	All subsets regression, Bayesian model selection, Model averaging (SS 12)
12	Apr 3 - 7	Two-way ANOVA model, Additive/non-additive model, ANOVA table

Week	Dates	Topics
13	Apr 10 – 14	Tests for a factors effect, Sequential sum of squares, Multiple comparisons
14	Apr 17 - 21	Test for interaction and interaction plots, Tests for block effects (SS 13)
15	Apr 24	Last day of classes

OTHER COURSE POLICIES

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 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 Greenville 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 at <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. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any

of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling [614-292-5766](tel:614-292-5766). CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at [614-292-5766](tel:614-292-5766) and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Requesting accommodations

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. 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; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This course requires use of CarmenCanvas (Ohio State's learning management system) and other 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