THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

SYLLABUS: STAT 3201
INTRODUCTION TO PROBABILITY FOR DATA ANALYTICS
AUTUMN 2022

Course overview

Instructor

Instructor: Kartik Lovekar
Email address: lovekar.1@osu.edu

Office hours: WF 1:30 – 2:30 PM CH217 (tentative)

Graders/Teaching Assistants

Grader: Chenze Li
Email address: li.13074@buckeyemail.osu.edu

Visit https://mslc.osu.edu/courses/stat/statistics for tutoring timings and instructions.

Course description

Statistics 3201 is a 3 credit course which offers an introduction to probability and its role in statistical methods for data analytics. Equal emphasis is placed on analytical and simulation-based methods for quantifying uncertainty. Approaches to assessing the accuracy of simulation methods are discussed. Students should have some prior knowledge of basic programming. Applications of probability and sampling to big-data settings are also discussed.

Course learning outcomes

By the end of this course, students should successfully be able to:

1. Quantify uncertainty about events using mathematical descriptions of probability.

2. Quantify uncertainty about events using simulation methods.
3. Assess the quality and accuracy of simulation-based descriptions of uncertainty.
4. Update a description of uncertainty based on new information.
5. Identify appropriate probability models for experiments/data and summarize expected outcomes from such models.
6. Use correlation and conditional expectation to describe the relationship between two random variables.
7. Quantify uncertainty about summary statistics for large data sets.

Course materials

The textbook and/or courseware for this course is being provided via CarmenBooks. Through CarmenBooks, students obtain publisher materials electronically through Carmen/Canvas, saving them up to 80% per title. The fee for this material is included as part of tuition and is listed as *CarmenBooks fee* on your Statement of Account. In addition to cost-savings, materials provided through CarmenBooks are available immediately on or before the first day of class. There is no need to wait for financial aid or scholarship money to purchase your textbook.

Unless you choose to opt-out of the program, you do NOT need to purchase any materials for this course at the bookstore. For more information on the program or information on how to opt out, please visit the CarmenBooks website.

- [Wackerly, Mendenhall and Sheaffer] • [*Mathematical Statistics with Applications*] • [7th edition] • [Cengage Learning] • [1111798788, 9781111798789]

Access this eBook through the **CARMENBOOKS reader link** in the course navigation of your Carmen course for this class.

Course technology

For help with your password, university e-mail, Carmen, or any other 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

Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Carmen

Technology skills necessary for this specific course

- CarmenZoom
- Collaborating in CarmenWiki
- Recording a slide presentation with audio narration
- Recording, editing, and uploading video

Necessary equipment

- Computer: current Mac (OS X) or PC (Windows 10+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed
- Microphone: built-in laptop or tablet mic or external microphone

Necessary software

- On occasion, I may use the statistical software package called R (The R Project for Statistical Computing; http://www.r-project.org/) to illustrate certain aspects. Here is the information for obtaining R.
    - 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 through Microsoft's Student Advantage program. Each student can install Office on five PCs or Macs, five tablets (Windows, iPad® and Android™) and five phones.
    - Students are able to access Word, Excel, PowerPoint, Outlook and other programs, depending on platform. Users will also receive 1 TB of OneDrive for Business storage.
    - Office 365 is installed within your BuckeyeMail account. Full instructions for downloading and installation can be found https://ocio.osu.edu/kb04733.

Course delivery

The class is scheduled to meet on MWF from 3:00 PM – 3:55 PM. For the Fall 2022 offering, the course will be taught in an in-person format.

Grading and faculty response

Grades

Assignment or category	Percentage
Homework	25
Project	10
Midterm 1	20
Midterm 2	20
Final Exam	25
Total	100

Late assignments

Generally late assignments are not accepted and written documentation is required for missed assignments. If you are unable to complete an assignment on time, please get in touch with me *as soon as possible* so we can discuss your situation.

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

Faculty 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 large weekly assignments, you can generally expect feedback within **7 days**.

E-mail

I will reply to e-mails within **24 hours on school days**.

Discussion board

I will check and reply to messages in the discussion boards every **24 hours on school days**.

Attendance, participation, and discussions

Student participation requirements

Regular attendance and class participation is required. Please let the instructor know via email if you plan to miss several lectures. Though attendance will not be taken daily, please remember that I fully am aware of which students consistently miss class.

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.

Other course policies

Health and safety

The Ohio State University Wexner Medical Center's Coronavirus Outbreak site (https://wexnermedical.osu.edu/features/coronavirus) includes the latest information about COVID-19 as well as guidance for students, faculty and staff.

I expect that you will read and follow the guidelines and requirements for campus safety, which are available at https://safeandhealthy.osu.edu.

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

- **Exams**: You must complete the midterm and final exams yourself, without any external help or communication.
- **Written assignments**: Your written assignments, including discussion posts, should be your own original work. In formal assignments, you should 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 formal collaboration with your classmates. While study groups and peer-review of major written projects is encouraged, remember that comparing answers on a quiz or assignment is not permitted. If you're unsure about a particular situation, please feel free just to ask ahead of time.

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/.

Copyright disclaimer

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

Accessibility accommodations for students with disabilities

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; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of Carmen (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.

- Carmen (Canvas) accessibility
- Streaming audio and video
- Synchronous course tools

Your mental health

As a student you may experience a range of issues that can cause barriers to learning, 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. 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 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273- TALK or at suicidepreventionlifeline.org

Disclaimer

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.

Course schedule

*Subject to changes

#	Date	Week	Topic to be covered*	Textbook reading
1	Wednesday, August 24, 2022	1	Orientation, course introduction	1.1
2	Friday, August 26, 2022	1	Introduction to R	
3	Monday, August 29, 2022	1	Introduction to R	
4	Wednesday, August 31, 2022	2	Characterizing data using numerical and graphical summaries	1.2-1.3
5	Friday, September 2, 2022	2	Characterizing data using numerical and graphical summaries	1.2-1.3
6	Monday, September 5, 2022	2	Labor Day – no class	
7	Wednesday, September 7, 2022	3	Introduction to probability and counting methods	2.1-2.6
8	Friday, September 9, 2022	3	Introduction to probability and counting methods	2.1-2.6
9	Monday, September 12, 2022	3	Introduction to probability and counting methods	2.1-2.6
10	Wednesday, September 14, 2022	4	Introduction to probability and counting methods	2.1-2.6
11	Friday, September 16, 2022	4	Introduction to probability and counting methods	2.1-2.6
12	Monday, September 19, 2022	4	Conditional probability and independence, probability laws, Bayes' Theorem	2.7-2.10
13	Wednesday, September 21, 2022	5	Conditional probability and independence, probability laws, Bayes' Theorem	2.7-2.10
14	Friday, September 23, 2022	5	Discrete random variables and probability distributions	3.1-3.2
15	Monday, September 26, 2022	5	Introduction to simulation and Monte Carlo (MC) estimation	
16	Wednesday, September 28, 2022	6	Expected value and variance	3.3
17	Friday, September 30, 2022	6	Expected value and variance	3.3
18	Monday, October 3, 2022	6	Review for Exam 1	
19	Wednesday, October 5, 2022	7	Exam 1	
20	Friday, October 7, 2022	7	Bernoulli, Binomial, Negative Binomial, Geometric, Hypergeometric, Poisson	3.4-3.8
21	Monday, October 10, 2022	7	Bernoulli, Binomial, Negative Binomial, Geometric, Hypergeometric, Poisson	3.4-3.8

22	Wednesday, October 12, 2022	8	Bernoulli, Binomial, Negative Binomial, Geometric, Hypergeometric, Poisson	3.4-3.8
23	Friday, October 14, 2022	8	Fall Break – no class	3.4-3.8
24	Monday, October 17, 2022	8	Continuous random variables and their probability distributions	4.1-4.3
25	Wednesday, October 19, 2022	9	Continuous random variables and their probability distributions	4.1-4.3
26	Friday, October 21, 2022	9	Uniform, Normal, Gamma, Exponential, and Beta	4.4-4.7
27	Monday, October 24, 2022	9	Uniform, Normal, Gamma, Exponential, and Beta	4.4-4.7
28	Wednesday, October 26, 2022	10	Uniform, Normal, Gamma, Exponential, and Beta	4.4-4.7
29	Friday, October 28, 2022	10	Functions of random variables	6.1-6.3
30	Monday, October 31, 2022	10	Functions of random variables	6.1-6.3
31	Wednesday, November 2, 2022	11	Functions of random variables	6.1-6.3
32	Friday, November 4, 2022	11	Sampling distributions, Central Limit Theorem	7.1-7.3
33	Monday, November 7, 2022	11	Exam 2 review	
34	Wednesday, November 9, 2022	12	Exam 2	
35	Friday, November 11, 2022	12	Veterans Day – no class	
36	Monday, November 14, 2022	12	Sampling distributions, Central Limit Theorem	7.1-7.3
37	Wednesday, November 16, 2022	13	Sampling distributions, Central Limit Theorem	7.1-7.3
38	Friday, November 18, 2022	13	Marginal and conditional distributions, independent random variables	5.3-5.4
39	Monday, November 21, 2022	13	Marginal and conditional distributions, independent random variables	5.3-5.4
40	Wednesday, November 23, 2022	14	Thanksgiving Break – no class	
41	Friday, November 25, 2022	14	Thanksgiving Break – no class	
42	Monday, November 28, 2022	14	Conditional expected values	5.11
43	Wednesday, November 30, 2022	15	Conditional expected values	5.11
44	Friday, December 2, 2022	15	Covariance and correlation	5.7
45	Monday, December 5, 2022	15	Final Review	
46	Wednesday, December 7, 2022	16	Final Review	
47	Friday, December 9, 2022	16	Final Exam	