



THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

# SYLLABUS: STAT 3201

## INTRODUCTION TO PROBABILITY FOR DATA ANALYTICS

### AUTUMN 2022

## Course overview

### Instructor

**Instructor:** Dr. Sanjeevani Weerasingha

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Office hours: Monday and Wednesday 10:00 AM – 11:00 AM, or by appointment

Office Location: Cockins Hall, Room 205C

### Grader or Teaching Assistant

**Grader:** Jiwon Hong (hong.1069)

### Course description

Statistics 3201 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.

**Prerequisites:** Math 1152 or 1161.xx or 1172 or 1181 or equivalent.

### 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

### Required textbook:

*Mathematical Statistics with Applications* (7th edition) by Wackerly, Mendenhall and Sheaffer.

The textbook 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](#).

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

A useful reference for R programming is *Introduction to Probability and Statistics using R* by Kerns, available to download for free online at <https://github.com/gjkerns/IPSUR/blob/master/IPSUR.pdf>. This book provides many excellent exercises and examples which are directly related to the course material.

## 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](mailto: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

## 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

- This class requires you to 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.**
- It may be helpful to become familiar with the (free) R Markdown authoring framework as you take this class; its use is required in future courses in this sequence. An online guide with overview information can be found at <https://rmarkdown.rstudio.com>.
- [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

This course meets **Mondays, Wednesdays, and Fridays in Jennings Hall 040 from 11:30 am - 12:25 pm**. Lectures will be delivered in person during the scheduled class meeting times. Students are expected to attend and participate in these in-person class meetings. Class meetings will be used to provide in-depth investigation of the topics for the week using a lecture format. Students will participate in these class sessions by engaging in discussions prompted by the instructor and by asking and answering questions. Students should plan to take notes during class.

On occasion, instructional videos may be posted to the class website. Such videos will replace a live lecture and will contain new course material and worked examples. You will be responsible for watching the videos, studying the new material and working through the examples presented in the videos or assigned as an exercise.

Weekly office hours will be held via in person, at the times and locations given above (see Instructor section).

# Grading and faculty response

## Grades

Assignment or category	Percentage
Homework	20
Quizzes	15
Midterm 1	20
Midterm 2	20
Final Exam	25
Total	100

## Assignment information

**Homework:** The goal of homework assignments is to help you learn the material. There will be homework assignments posted on the course website, and they will be typically due once per week, with dates and times provided. They will consist of mostly textbook-style problems, problems motivated by data analytics applications, and small computer simulation problems. Any question numbers referenced in the homework are from the textbook edition listed above. If you are using a different edition/version of the textbook, it is your responsibility to check that you have solved the correct questions. Homework may be typed or handwritten and scanned; if handwritten, the student is responsible for verifying that the writing is clear and legible and the scanned version is of good quality (e.g., not blurry). Any R code and output must be typed. Please be sure that the questions are clearly labeled, all supporting work (including computer code) can be easily identified, and that all figures/tables are referenced and interpreted in the text.

**Academic Integrity and Collaboration for Homework:** You are encouraged to work with other Stat 3201 students on homework and you may consult references both internal and external to the course material. **Each student must produce their own assignment to be handed in. Do not copy any part of another student's homework. You must list at the top of your homework your collaborators and any references (texts or other online materials) that you consulted. Use of homework solutions distributed in previous offerings of the course or available on the web constitutes academic misconduct and will be handled according to university rules.**

**Quizzes** will be given frequently during lectures. These short quizzes are meant to motivate you to participate actively in classroom activities and keep you up with the material introduced during class. Also, it gives you incentive attendance and participation. These quizzes will not be made up and if you do not attend lecture, you cannot attempt, submit, or receive credit for these assignments. The quizzes are open book / open notes, and **you are strongly encouraged to work together with your neighbors in the classroom**. I will drop your lowest quiz score when computing your quiz grade for the semester.

#### **Exams:**

There will be two midterms and one final exam administered during the semester to assess your understanding of the course material as the semester progresses. The final exam will take place at the time and date established by the university. Information about the exams will be posted well in advance on Carmen. **Exams must be completed without any external help or communication.** The information about the exams given below.

## **Late assignments**

Generally late assignments are not accepted. 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 weekly assignments, you can generally expect feedback within **7 days**.

## E-mail

I will reply to e-mails within **48 hours on school days**. Specific technical questions about the course material that require significant back-and-forth communication are not well suited for e-mail; while I will do my best to answer such questions, I may ask that you attend office hours if your question isn't easily answerable over email.

# Attendance, participation, and discussions

## Student participation requirements

Because this is a distance-education course, your attendance is based on your online activity and participation. The following is a summary of everyone's expected participation:

- **Logging in: AT LEAST TWICE PER WEEK**  
Be sure you are logging in to the course in Carmen each week, including weeks with holidays or weeks with minimal online course activity. (During most weeks you will probably log in many times.) If you have a situation that might cause you to miss an entire week of class, discuss it with me *as soon as possible*.
- **Office hours and live sessions: OPTIONAL/FLEXIBLE, BUT STRONGLY ENCOURAGED**  
All live, scheduled events for the course, including my office hours, are optional. For synchronous content, I will provide a recording that you can watch later.

## 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.

- **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.)

## Course schedule (tentative)

Week	Dates	Topics, Major Deadlines
1	Aug 24, 26	Orientation and course introduction; introduction to R
2	Aug 29, 31; Sep 2	Characterizing data using numerical and graphical summaries
3	Sep 7, 9	Introduction to probability and counting methods
4	Sep 12, 14, 16	More probability and counting methods
5	Sep 19, 21, 23	Probability Laws and Bayes' Theorem
6	Sep 26, 28, 30	Discrete random variables; expected value and variance
7	Oct 3, 5, 7	<b>Midterm 1 Oct 3</b> ; Named discrete distributions
8	Oct 10, 12	Named discrete distributions
9	Oct 17, 19, 21	Continuous random variables
10	Oct 24, 26, 28	Named continuous distributions
11	Oct 31; Nov 2, 4	Functions of random variables
12	Nov 7, 9	Sampling distributions, central limit theorem
13	Nov 14, 16, 18	<b>Midterm 2 Nov 14</b> ; Bivariate distributions
14	Nov 21	Marginal and conditional distributions
15	Nov 28, 30; Dec 2	Conditional expected values; covariance and correlation
16	Dec 5, 7	Bivariate Normal distribution
FINAL	Dec 15	<b>Final Exam (10:00am-11:45am)</b>



## Academic integrity policy

**Academic integrity is a shared responsibility. We want to have a supportive and fair learning environment for all students.** If you find yourself struggling with the course material as the semester proceeds, reach out to me or to the other teaching staff for extra assistance. Attend office hours. If you are struggling on homework assignments or quizzes, reach out to me or to other students for help. Violations of academic integrity standards on the part of even a single student can have negative repercussions for all students. For example, if we detect evidence of cheating on exams, not only will the procedures for investigation of academic misconduct be pursued for any involved students, but it may also result in more stringent administration of subsequent exams. **Please help us to maintain a positive and fair learning environment for all students by adhering to these policies for academic integrity.**

Policies specific to Homework, quizzes, and exams are detailed in the **Assignment Information** section.

### 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/>.

## 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>.

If you are unable to attend or participate in class for an extended period of time due to illness or quarantine, please let me know as soon as possible and we will make arrangements.

### 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>.

### 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 at [titleix@osu.edu](mailto:titleix@osu.edu)

## Accessibility accommodations for students with disabilities

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](mailto:slds@osu.edu); 614-292-3307; <http://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](https://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](https://www.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.