



# THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

## **SYLLABUS: STAT 4201 INTRODUCTION TO MATHEMATICAL STATISTICS I AUTUMN 2020**

### Course overview

#### Instructor

Instructor: David J. Sivakoff  
Email address: [dsivakoff@stat.osu.edu](mailto:dsivakoff@stat.osu.edu)  
Class Website: <https://osu.instructure.com/courses/85016>  
Lectures: On CarmenZoom, MWF at 8:00-8:55am (EDT/EST, Ohio Time Zone). (Some of these lectures will be presented asynchronously, see *Course Delivery* below.)  
Office hours: Virtual Hours via CarmenZoom: Times will be posted on course website, and syllabus updated accordingly, once office hours are scheduled.

#### Grader or Teaching Assistant

Recitations: T 8:00-8:55am and T 3:00-3:55pm (on CarmenZoom).  
TA: Pashmeen Kaur  
Email address: [kaur.138@osu.edu](mailto:kaur.138@osu.edu)  
Office hours: Virtual hours via CarmentZoom: Times will be posted on course website, and syllabus updated accordingly, once office hours are scheduled.

Recitations: T 4:10-5:05pm and 5:20-6:15pm (on CarmenZoom).  
TA: Shuyi Wang  
Email address: [wang.7649@osu.edu](mailto:wang.7649@osu.edu)  
Office hours: Virtual hours via CarmentZoom: Times will be posted on course website, and syllabus updated accordingly, once office hours are scheduled.

Grader: Yue Yu

## Course description

This is the first course in a two-semester sequence on probability and mathematical statistics. The focus of STAT 4201 will be on introducing some of the basic concepts in probability theory. Topics to be covered include basic counting, set theoretic notation, the axioms of probability spaces, discrete and continuous distributions and densities, random variables, expectation and moments, functions of random variables and transformation techniques, common sampling distributions, and order statistics. These topics are covered in the first 8 chapters of the required textbook.

Prerequisites: C- or better in MATH 2153, 2162.xx, 2182H, or 4182H, or permission of instructor.

## Course learning outcomes

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

- Understand the basic concepts in probability and statistics.
- Compute probabilities and statistics of discrete and continuous distributions.
- Comprehend the probabilistic methods needed to analyze and critically evaluate statistical models and arguments.
- Recognize the importance of statistical ideas.

## Course materials

### Required

*John E. Freund's Mathematical Statistics with Applications*, Eighth Edition by Irwin Miller and Marylees Miller, 2014.

The textbook for this course is being provided via CarmenBooks. Through CarmenBooks, students obtain publisher materials electronically through CarmenCanvas. *The fee for this material is included as part of tuition and is listed as CarmenBooks fee on your Statement of Account.* Materials provided through CarmenBooks are available immediately on or before the first day of class.

*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.

### Supplemental References

*Introduction to Probability* by David F. Anderson, Timo Seppäläinen and Benedek Valkó, 2018.

*Probability* by Jim Pitman, 1993.

I will refer to these books, in addition to the required text, when creating course materials.

## 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)
- **TEL:** 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

## 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
- A scientific calculator. The one on your phone or computer is acceptable. You may also use a graphing calculator, but not one with a computer algebra system (CAS) for exams and quizzes.

## Necessary software

- You will need to have the ability to scan written work to upload certain assignments as PDF files through Carmen. There are a variety of free apps that can do this (search for "PDF scanner"). For instance, the Notes application that comes standard on an iPhone or iPad has this capability.  
Alternatively, you may use a tablet computer with a stylus to write your solutions using a handwriting app, then save them as a PDF file to upload to Carmen.

## Optional software and technology skills

- Basic programming skills using a statistical or mathematical language, such as R, Python, Matlab, etc. This will not be essential for quizzes or exams, but simulating certain

random experiments can help guide intuition. (R and Python are freely available on most platforms, and very good online tutorials exist for each.)

## Course delivery

The course will be a mix of synchronous and asynchronous content. Synchronous content will be presented live over CarmenZoom, and asynchronous content will be delivered by recorded lectures posted on the class website. **Details of the weekly schedule will be announced at the start of each week.**

Each week, we will cover approximately 220 minutes of content in total, which includes 55 minutes of recitation. You will be responsible for watching any live content or recorded videos and studying the material that is assigned. In addition to the lecture videos, assignments will be posted on the class website (Carmen). You will be given ample time to complete the assignments.

The instructor will deliver live CarmenZoom lectures for certain topics. In this case, the **lecture will be recorded** and posted on the class website soon after. Live lectures will usually be on Mondays and Wednesdays at the scheduled class time (8:00-8:55am EDT/EST).

The instructor will hold weekly office hours via CarmenZoom. The days and times will be announced later and posted on the Carmen website. The instructor will also initiate and manage active discussion boards, also via Carmen.

Each week, a recitation activity (usually a set of problems) will be posted on the course webpage. The recitation activities will typically be accompanied by live CarmenZoom interactions for group work moderated by the TA (which may not be recorded) and other educational materials.

Apart from live lectures and recitations via CarmenZoom, the majority of the course can be completed asynchronously, meaning that you will have some flexibility to study materials and work on assessments according to your own daily schedule. In particular, all quizzes and exams will have a window of times during which you can start the assessment activity, and a fixed duration. For example, a quiz may be announced (in advance) for a Friday, so students would have a 24-hour window to start the quiz, and once the quiz is started it would need to be completed within the next 20 minutes (for instance – these parameters will depend on the assignment).

## Grading and faculty response

### Homework, Quizzes and Exams

Assignment or category	Percentage
Lecture Comprehension Quizzes (Weekly)	25
Summative Assessment Quizzes (Weekly)	20
Homework (Weekly)	20
Midterm Exams (2)	20
Final Exam	15
<b>Total</b>	<b>100</b>

Grades will be recorded on the class website.

**Homework** will be due at 11:59pm on the day it is due. Typically, no late homework will be accepted. However, 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. You are encouraged to work together on the homework, but do not copy any part of a homework. Each student must produce his/her own homework to be submitted electronically. Students are not permitted to look up or request solutions to homework problems in online forums or websites. All homework must be submitted online as a PDF file through the class website. Feel free to ask me for help during my office hours after you have made an attempt of the questions.

The graders for the course do not have the time to provide detailed explanations on each question that is graded. To make up for this, I will endeavor to create homework solutions that are detailed enough to allow you to understand how the question could be approached.

**Homework preparation rules:** Put your name and the homework assignment number on the top right corner of every page. Submit the problems in order. The purpose of the written homework is to assess and provide feedback on your understanding of and ability to explain the reasoning behind complex derivations or probabilistic arguments, which are difficult to assess via a Carmen quiz. Therefore, **answers with little or no explanation or work shown will receive no credit**. The lowest homework score will be dropped at the end of the semester.

**Quizzes:** There will be two types of weekly quizzes: “Lecture Comprehension Quizzes” and “Summative Assessment Quizzes.” All quizzes will take place through the course website. The lowest quiz score of each type will be dropped at the end of the semester.

**Lecture comprehension quizzes** are meant to assess basic understanding of the recorded lecture content and should be completed after viewing posted video lectures. These will usually consist of straightforward problems that mimic examples explained during the lecture, and can be attempted twice.

**Summative assessment quizzes** are meant to assess deeper understanding of the material and will typically be offered on Fridays throughout the term, except during exam weeks. These will usually consist of slightly more challenging problems than the comprehension quizzes, but will be based on those covered during live recitations, live lectures and on the homework. These quizzes can be attempted only once.

**Exams:** There will be two midterm exams and one final exam:

Midterm 1	Fri, Oct 2
Midterm 2	Fri, Nov 6
Final	Tue, Dec 8

All exams and quizzes are open book and open notes but **must be completed alone**. Use of any other materials are forbidden, including any websites or software packages. A calculator is allowed, but only one that does not have computational algebra capabilities.

The first midterm covers material up to and including Wed Sep 30.

The second midterm covers material up to and including Wed Nov 4.

The final will cover all the material for the course.

## Late assignments

Late assignments will generally not be accepted, as the lowest homework and quiz scores will be dropped to account for missed assignments. If you cannot participate in the course for a prolonged period of time due to personal illness or family responsibilities due to illness, please contact me immediately to discuss options for completing work.

## 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 homework, you can generally expect feedback within **7-10 days**.

### E-mail

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

# 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:

- **Live recitations: FLEXIBLE**  
Students will be expected to participate in group problem solving during online live recitations. If you must miss a recitation, you are responsible for making sure that you understand the material that was covered.
- **Live lectures: FLEXIBLE**  
Students will be expected to participate and ask questions in online live lectures. Live presentations will be recorded, so students can watch them later.
- **Recorded lectures: FLEXIBLE**  
**Students are required to watch each recorded lecture and take a Lecture Comprehension Quiz afterward.**
- **Logging in: AT LEAST TWICE PER WEEK**  
Students are required to log in to the course in Carmen each week, including weeks with holidays. (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: OPTIONAL**  
All office hours are optional.

## 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 acceptable 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. Guidelines and requirements for campus safety from the University's COVID-19 Transition Task Force were published on July 1 on the Safe and Healthy website (<https://safeandhealthy.osu.edu>).

### Potential disruptions to instruction

- As much as is possible, students will have access to material online if they are unable to attend class because of positive diagnosis, symptoms, or quarantine required following contact tracing.
- If the instructor is unable to be present in person because of positive diagnosis, symptoms, or quarantine following contact tracing a new instructor will be assigned to the course. Details will be given on the course website.
- In the (hopefully) unlikely event that an instructor or TA does not arrive on time for a live meeting, please wait for at least 10 minutes beyond the scheduled start time. If the instructor or TA still does not arrive, please look for an announcement on Carmen specifying a makeup time or a recorded alternative for the missed activity.

### 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 and exams:** You must complete the midterm and final exams yourself, without any external help or communication. You may use only your textbook and notes, and a calculator that does NOT have a computer algebra system (CAS).

- **Written assignments:** Your written assignments, including discussion posts and homework, should be your own original work. DO NOT use websites to look up (or request) solutions to problems. Paraphrasing a solution that is not your own still constitutes plagiarism.
- **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.
- **Collaboration and informal peer-review:** The course includes many opportunities for formal collaboration with your classmates. While study groups are 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.

Please **do not disseminate any course materials, including lecture videos, assignments, and solutions** outside of the course.

### Statement on title IX (Recommended)

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](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](http://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](http://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 (tentative)

Week	Dates	Topics (sections in textbook, roughly)
1	Aug 26, 28	Basic counting, axioms of probability (1, 2.1-2.4)
2	Aug 31, Sep 2, 4	Conditional Probability, Independent events, Bayes' theorem (2.5-2.8) Random variables, probability distributions (3.1-3.2)
3	Sep 9, 11	Continuous random variables, probability density functions, multivariate distributions (3.3-3.5)
4	Sep 14, 16, 18	Marginal and conditional distributions (3.6-3.7) Expected value, moments and Markov/Chebyshev inequalities (4.1-4.4)
5	Sep 21, 23, 25	Moment-generating functions, Product moments, Moments of linear combinations (4.5-4.7)
6	Sep 28, 30, Oct 2	Conditional expectation (4.8) Discrete distributions: Uniform and Bernoulli (5.1-5.3) <b>Midterm 1 on Oct 2</b>
7	Oct 5, 7, 9	Discrete distributions: Binomial, Negative Binomial, Geometric, Hypergeometric, Multivariate Hypergeometric (5.4-5.6, 5.9)
8	Oct 12, 14, 17	Discrete distributions: Poisson, Multinomial (5.7-5.8)
9	Oct 19, 21, 23	Probability density functions: Uniform, Gamma, Exponential, Chi- square, Beta, Weibull, Pareto (6.1-6.4)
10	Oct 26, 28, 30	Normal distribution, Normal approximation to Binomial, Bivariate normal (6.5-6.7)
11	Nov 2, 4, 6	Functions of random variables: distribution functions, single variable transformations (7.1-7.3) <b>Midterm 2 on Nov 6</b>
12	Nov 9, 13	Transformation techniques: several variables and moment generating functions (7.4-7.5)
13	Nov 16, 18, 20	Sampling distributions, Sampling distribution of the mean, Central Limit Theorem (8.1-8.3)

<b>14</b>	Nov 23, 25	Distribution of mean in finite populations, Chi-square distribution (8.3-8.4)
<b>15</b>	Nov 30, Dec 2, 4	t-distribution, F-distribution, Order Statistics (8.5-8.7)

**Final exam is on December 8.**