THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

SYLLABUS: STAT 7201
PROBABILITY
AUTUMN 2021

Course overview

Instructor

Instructor: David J. Sivakoff
Email address: dsivakoff@stat.osu.edu
Class Website: https://osu.instructure.com/courses/108052
Lectures: MWF at 1:50-2:45pm (EDT/EST) in N056 Scott Lab
Office hours: TR 9:00-10:00am and by appointment (please schedule appointments at least
                  24 hours in advance).

Course description

STAT 7201 is a measure-theoretic probability course. Complementing earlier courses on the topic, our focus will be on developing a deeper understanding of the modern mathematical theory of probability and its relevance to statistics. Students will also develop their ability to construct and communicate rigorous mathematical proofs.

Course learning outcomes

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

- understand probability models from a measure-theoretic perspective,
- write rigorous proofs using mathematical probability concepts,
- connect probabilistic concepts and results to their statistical applicability.

Course materials

Required

A Probability Path by S. Resnick, Birkhauser, 2005. The book is available for download here:
https://link-springer-com.proxy.lib.ohio-state.edu/book/10.1007%2F978-0-8176-8409-9

Supplemental References

Probability: Theory and Examples by R. Durrett, Duxbury Press;

Probability and Measure by P. Billingsley, Wiley, 1995;

A Course in Probability Theory, by K.L. Chung, Academic Press, 1990;

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
- **TEL:** 614-688-8743

Baseline technical skills necessary for this course

- Basic computer and web-browsing skills
- Navigating Carmen

Necessary equipment

- Computer: current Mac (OS X) or PC (Windows 10+) with high-speed internet connection.
- Scanner/Copier, Phone with camera, or tablet computer.

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. Also, the Statistics Department copy machines are capable of scanning documents to PDF.
  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.

Course delivery

Lectures will be delivered live in person. Office hours are in person, but appointments can be made to meet via CarmenZoom.

Grading and faculty response

Homework, Quizzes and Exams

Assignment or category	Percentage
Homework (bi-weekly)	20
Quizzes (bi-weekly)	20
Midterm Exam	25
Final Exam	35
Total	100

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 their 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 earnestly attempted the questions.

The grader for the course may 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: All quizzes will take place in person during lecture on the assigned day. The lowest quiz score will be dropped at the end of the semester. Quizzes must be completed alone without the use of textbook or notes.

Exams: There will be one midterm exam and one final exam:

Midterm	Fri, Oct 29 at 1:50pm
Final	Wed, Dec 15 at 2pm

All exams are to be taken without use of your notes or textbook and 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 midterm covers material up to and including lecture on Wed Oct 27.
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

The following is a summary of everyone's expected participation:

- **Live, in-person lectures: THREE TIMES PER WEEK**
  Students will be expected to participate and ask questions during live lectures.

- **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 proper 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 Cornavirus 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 the Safe and Healthy website (https://safeandhealthy.osu.edu).

Potential disruptions to instruction

- As much as is possible, students will have access to course materials online if they are unable to attend class because of positive diagnosis, symptoms, or quarantine required following contact tracing.

- In the (hopefully) unlikely event that an instructor does not arrive on time for a live meeting, please wait for at least 10 minutes beyond the scheduled start time. If the instructor 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 quizzes and midterm and final exams yourself, without any external help or communication. You may not use your textbook or notes. You may use 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**: Study groups are encouraged, and you are welcome to discuss and work on homework problems with classmates. However, remember that the work you turn in must be your own, and that comparing answers on a quiz or exam is not permitted. If you're unsure about a particular situation, please feel free 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 any 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

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; 614-292-3307; http://slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This 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.

Tentative schedule of topics.

Week	Dates	Topics
1	8/25 – 8/27	Introduction, Set operations and limits
2	8/30 – 9/3	Sigma-fields, Borel sigma-field, Measure/Probability spaces
3	9/8 – 9/10	Distributions, Pi-Lambda and Extension theorems
4	9/13 – 9/17	Random variables, Induced measures
5	9/20 – 9/24	Independence
6	9/27 – 10/1	Zero-one laws, Tail sigma-field
7	10/4 – 10/8	Lebesgue integration, MCT, Fatou's lemma
8	10/11 – 10/13	Radon-Nikodym Thm, Conditional Expectation
9	10/18 – 10/22	Conditional Expectation, L^p spaces, Product spaces
10	10/25 – 10/29	Modes of convergence, Uniform integrability
11	11/1 – 11/5	Weak Law of Large Numbers (LLN), Strong LLN
12	11/8 – 11/12	Strong LLN, Random Series
13	11/15 – 11/19	Convergence in distribution
14	11/22	Convergence in distribution
15	11/29 – 12/3	CLTs
16	12/6 – 12/8	CLTs