



THE OHIO STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

# **SYLLABUS: STAT 7201**

## **PROBABILITY THEORY**

### **AUTUMN 2023**

## **Course overview**

### **Instructor**

Instructor: Radu Herbei

Email address: herbei.1@osu.edu

Office hours: Mondays 11:30 – 12:30 CH223, and by appointment.

The TA will also hold two office hours per week via Carmen Zoom. The times will be announced soon.

Office Location: CH 223.

### **Course description**

Statistics 7201 is a measure-theoretic probability course, which introduces probability from a general and rigorous mathematical viewpoint. This course complements other courses on this topic that you may have had and will help you gain a deeper and more thorough understanding of probability and its relevance in statistics and in the real world. Students will also develop skills in constructing rigorous proofs.

### **Course learning outcomes**

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

- understand probability models from a measure-theoretic perspective
- develop rigorous proofs using advanced 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>

### Optional materials

*Probability and Measure* by P. Billingsley, Wiley, 1995;  
*A Course in Probability Theory*, by K.L. Chung, Academic Press, 1990;  
*Probability: Theory and Examples* by R. Durrett, Duxbury Press;  
*Probability for Statisticians* by G. Shorack, Springer.  
<https://link-springer-com.proxy.lib.ohio-state.edu/book/10.1007/978-3-319-52207-4>

## 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
- 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

- [Microsoft Office 365 ProPlus](#) All Ohio State students are now eligible for free Microsoft Office 365 ProPlus through Microsoft's Student Advantage program.
  - Students are able to access Word, Excel, PowerPoint, Outlook and other programs, depending on platform.
  - 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 meets on MWF from 10:20am – 11:15am in EC0222. The class is offered “in-person”. Unless mandated by the University, the class will not have a parallel online content-delivery system. At the instructor's discretion, certain lectures may be recorded and/or delivered online only.

The instructor will hold weekly office hours via CarmenZoom as indicated above. When appropriate, the instructor will also initiate and manage active discussion boards, also via Carmen.

## Grading and faculty response

### Grades

Assignment or category	Percentage
In-class participation	10%
7 x In-class assessments (10% each)	70%
Final Exam	20%
Total	100%

## Assignment information

**Homework:** I will not assign and collect homework for grading purposes. At the end of each Chapter, the textbook contains a collection of practice problems. Students are encouraged to attempt many of these problems in preparation for in-class assessments and exams. A list of suggested practice problems and selective solutions will be available on Carmen.

**In-class participation.** Students are expected to attend each class and participate in the discussion (ask and answer questions, share opinions, etc.). I will take attendance on a random basis. If you'll miss a class, I hope that you will send me a short note, to let me know.

**In-class assessments:** We will have regular (every two weeks) in-class assessments. These will take roughly 30 minutes and will be slightly longer than a quiz, but less than an exam. Each assessment will contain 2-3 problems on the topics covered in class most recently. The tentative dates for these assessments are:

- A1: September 6, 2023.
- A2: September 20, 2023.
- A3: October 4, 2023.
- A4: October 18, 2023.
- A5: November 1, 2023.
- A6: November 15, 2023.
- A7: November 29, 2023.

**Final Exam:** The Final Exam is scheduled for **Friday, December 8, 10:00am – 12:00pm**. The final exam is comprehensive. More information will be communicated well in advance during class and through the course website. At the instructor's discretion, exams and assessments may be delivered online, through Carmen. For online exams, **Proctorio** may be used as a security tool.

## 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

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

- Since the class is offered in-person, students are required to attend class **in person**.
- **Logging in: AT LEAST ONCE 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 OR FLEXIBLE**  
My office hours, are optional. If you wish to discuss an assignment with me, please contact me if you need a time outside my scheduled office hours.
- **Participating in discussion forums: SEVERAL TIMES PER WEEK**  
You are encouraged to participate in discussion forums, if you choose to do so.

### 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

- **Quizzes and 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. 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 opportunities for 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. You must obtain my permission before sharing any of the materials associated with this course with others not enrolled in the class.

## 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](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)



## Religious Accommodations

It is Ohio State's policy to reasonably accommodate the sincerely held religious beliefs and practices of all students. The policy permits a student to be absent for up to three days each academic semester for reasons of faith or religious or spiritual belief.

Students planning to use religious beliefs or practices accommodations for course requirements must inform the instructor in writing no later than 14 days after the course begins. The instructor is then responsible for scheduling an alternative time and date for the course requirement, which may be before or after the original time and date of the course requirement. These alternative accommodations will remain confidential. It is the student's responsibility to ensure that all course assignments are completed.

## 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

Week	Dates	Topics, Readings, Assignments, Deadlines
1	8/23 – 8/25	Introduction, Classes of Sets
2	8/28 – 9/1	Sigma-fields, Borel sigma-fields, Induced sigma-fields
3	9/4 – 9/8	Probability measures
4	9/11 – 9/15	Pi-systems, Lambda systems, extension theorem
5	9/18 – 9/22	Inverse maps, measurability
6	9/25 – 9/29	Independence
7	10/2 – 10/6	Zero-one laws, Tail sigma-fields.
8	10/9 – 10/13	Integration, MCT, Fatou's lemma. (Fall Break Week)
9	10/16 – 10/20	Radon-Nikodym's Theorem; Conditional Expectation
10	10/23 – 10/27	Conditional Expectation; Product spaces
11	10/30 – 11/3	Convergence concepts
12	11/6 – 11/10	Laws of large numbers
13	11/13 – 11/17	Sums of independent rvs, Convergence in distribution
14	11/20/20 – 11/24	Convergence in distribution, CLTs (Thanksgiving Week)
15	11/27/20 – 12/1/20	CLTs
16	12/4 – 12/8	Selective topics, Recap, Exercises (Final Exam week)