

MATH 5010/6805-01: Introduction to Probability

Spring 2022 Syllabus

Time and Location: Monday, Wednesday, Friday 9:40-10:30am in [JFB B-1](#)

Instructor: Sean Groathouse
he/him/his pronouns
preferred name/address: Sean

Email: sean@math.utah.edu

Office Hours (Tentative): Wednesdays 10:30-11:00am, on campus after class
Fridays 10:30-11:00am, on campus after class
Tuesdays 12:30-1:30, online through Zoom
before or after class most days
or by appointment

Course Web Page: I will post all course information and announcements on Canvas:
<https://utah.instructure.com/courses/757685>

Prerequisites: C or better in MATH 2210 or MATH 1260 or MATH 1280 or MATH 1321 or MATH 3140.

Textbook: *Introduction to Probability*, by Anderson, Seppäläinen, Valkó; ISBN: 978-1108415859

Course Description: Introduction to probability theory including combinatorial analysis, conditional probability, independence, discrete and continuous random variables, jointly distributed random variables, expected value and moments, the Law of Large Numbers, and the Central Limit Theorem.

Expected Learning Outcomes: At the end of the course, students will be able to:

- Define probability in terms of a sample space and construct a sample space to model a situation.
- Use the rules of probability and combinatorics to reason probabilistically.
- Calculate conditional probabilities, apply Bayes' Rule, and understand independence of events and random variables.
- Work with discrete and continuous random variables from standard distributions or from a given pmf/pdf/CDF. Work with jointly distributed random variables.
- Compute MGFs and utilize them to understand a sum of independent random variables.
- Calculate expected values and moments of random variables. Utilize the linearity of expectation and independence properties.
- Compute and interpret variance, covariance, and correlation of random variables.
- Understand the Law of Large Numbers and Central Limit Theorem and apply them.
- Calculate conditional distributions and understand conditional expectation as a random variable.
- Continue using probability in further classes such as Stochastic Processes (5040), Statistical Inference (5080), Math Finance (5760), and Actuarial Math (5030).

Class Structure: During class, I will use my laptop as a tablet to write on our course notes, projected on the board. We will have an outline of the notes so we do not need to copy down lengthy definitions/facts. I will have printed copies for the first week of class. After that, you will need to choose a way to have these available during class. One option is to print the notes for free in the Math Center (located in the basement between LCB and JWB). You could also use a hybrid laptop/tablet to write digitally on the files. Another option would be to create your own handwritten template based on the course notes template. It's up to you how you take notes best. I will also post the completed version of the notes from class on Canvas. The goal is that hopefully this frees us up from copying down lengthy definitions and facts, and instead we can spend that time digesting the new content and applying it to examples.

Class Recordings: Most of our class time will be recorded and uploaded to Canvas. The video will show the class notes which are projected in the room and will include an audio recording of our class. On days when we have a quiz or are doing group work, that portion of the class will not be recorded, but I'll start the recording once we are going through the class notes. I'll also post the completed version of the class notes on Canvas. Please let me know if you have any concerns about our class audio being recorded.

Grading: Grades will have the following weights and scale:

Homework	10%	[93, 100] A	[80, 83) B-	[67, 70) D+
Mini-Projects	10%	[90, 93) A-	[77, 80) C+	[63, 67) D
Quizzes	15%	[87, 90) B+	[73, 77) C	[60, 63) D-
Midterms	40%	[83, 87) B	[70, 73) C-	[0, 60) E
Final Exam	25%			

Although I'm not philosophically opposed to curving grades, I find it's usually not necessary. If I do need to curve the grades, I will explain any modifications to this scale on Canvas.

Homework: Homework will be assigned weekly, due on Wednesdays. It will be graded for completion. Although the homework will not be graded for correctness, I believe working on these problems is one of the best ways to learn the material. The final answers are available so you can check your work, and I am always happy to discuss homework problems.

Mini-Projects: We will have four mini-projects during the semester due on Fridays. They will provide an opportunity to apply some of the topics we are studying to different problems, and I hope they will cover a variety of interests related to our class. If you like, you may work with other students in our class in groups of 2 or 3 and submit one write-up for the group.

Quizzes: Each week on Wednesday, except for the first week and weeks of a midterm, we will have a short quiz in class based on the homework for that day. These quizzes are open book, open notes, and you may work in groups if you like. I will go around the room answering questions as well. The quizzes are not meant to be exams, but rather the goal is to check-in with our understanding of the material and get practice solving exam-like questions. Generally there will not be makeup quizzes, but I will drop the lowest 3 quiz scores.

Submitting your work: Homework and Mini-Projects will be turned in online through Canvas. Please submit your work as one of these file types if possible (these work the best with Canvas): pdf, jpg, jpeg, png, bmp, tif, tiff, doc, docx, odf, or odt. Certain phones may take pictures in a proprietary format that doesn't work well with Canvas. This can usually be changed in the settings, or you could use a scanner app to create a pdf file instead. You can also email your work or turn it in during class if there are any issues with Canvas.

Late Work: I will accept late homework for full credit up to two weeks late. Two weeks after the due date, I will enter zeros in Canvas for any missing homework. You may still turn in homework after that point for 85% credit through the day of the final exam.

I generally will not accept late mini-projects, since solutions may be available at that point. In cases of illness or emergency, please let me know as soon as possible so we can work something out.

There are generally no makeup/late quizzes, but I will drop the lowest 3 quiz scores. If because of illness, emergency, or the pandemic, you expect to miss more than 3 quizzes, please let me know as soon as possible so we can work something out.

Midterm Exams: We will have two midterm exams during class time on Friday, February 25, and Friday, April 8. Each midterm will include material covered in class through the previous week. Review materials will be posted on Canvas, and we will have some review sessions during the week of the exam.

Final Exam: We will have a comprehensive final exam on Tuesday, May 3 from 8:00-10:00am in our usual classroom JFB B-1. Review materials will be posted on Canvas, and we will have review sessions the week leading up to the final.

Calculators: On the midterms and final exam, you may use an arithmetic or scientific calculator. Graphing calculators and calculators which can connect to the internet or download software are not allowed on the exams. I will try to keep the arithmetic on the exams nice enough that a calculator is not essential.

On homework and mini-projects, you are welcome to use a calculator or software to help with calculations.

GradeScope: The midterms, quizzes, and final exam will be graded and returned digitally on GradeScope. You can access GradeScope through a link in Canvas, or through an email sent once the exam is graded.

Additional Class Policies

- I will post announcements, messages, and grades on Canvas, so it is essential that you either check Canvas regularly or have Canvas notifications forwarded to an email that you do check.
- Please make sure you do your best throughout the semester, knowing the grading scheme and what's expected of you, and talk to me if you need further study strategies. I am happy to brainstorm ideas to help you maximize your study strategies and improve your mathematical understanding. No extra credit will be provided at the end of the course, so please talk with me early on about any concerns with your grade, so we have time to address them.
- If you have crisis-level extenuating circumstances which affect your class performance, and you need guidance/advice/flexibility, please communicate with me as soon as possible so I can help you in some manner, which I'm truly happy to do. The longer you wait to communicate with me, the less I can do to help.
- If you want to appeal the grading of a mini-project, quiz, or exam, I ask that you please bring it to me within one week of it being returned (and also by the announced date at the end of the semester). This policy helps me maintain consistency in grading and helps make sure I can address any grading issues before the final grades are submitted. I'm always happy to look over any classwork with you, answer any questions you have, and fix any grading issues when appropriate.
- It is possible during the semester that I may need to modify this syllabus to help meet the learning goals of our class. If I do need to make any changes, I will announce them in class and on Canvas.

Covid-19 Specific Information

Our class is scheduled to meet in-person throughout the semester. It is possible that we will be put under quarantine at some point in the semester. If this happens we will switch to meeting on Zoom during class time until our quarantine is lifted.

I know that this semester may be more challenging than other semesters due to the pandemic, and there may be certain weeks where you cannot come to campus. I will post on Canvas recordings of each class, and the blank and completed versions of the class notes. Also our Tuesday office hour will always be online through Zoom so that there is an online option.

Additionally here is some information from our university leadership which applies to all classes: University leadership urges all faculty, students, and staff to model the vaccination, testing, and masking behaviors we want to see in our campus community. These include:

Vaccination: Get a COVID-19 vaccination if you have not already done so. Vaccination is proving highly effective in preventing severe COVID-19 symptoms, hospitalization and death from coronavirus. Vaccination is the single best way to stop this COVID resurgence in its tracks. Visit <http://mychart.med.utah.edu/>, <http://alert.utah.edu/covid/vaccine>, or <http://vaccines.gov/> to schedule your vaccination.

Masking: While masks are no longer required outside of Health Sciences facilities, UTA buses and campus shuttles, CDC guidelines now call for everyone to wear face masks indoors.

Testing: If you are not yet vaccinated, get weekly asymptomatic coronavirus tests. This is a helpful way to protect yourself and those around you because asymptomatic individuals can unknowingly spread the coronavirus to others. Saliva based testing is available at alert.utah.edu/covid/testing

Self-Reporting: All of us, including faculty, students, and staff, must self-report if we test positive for COVID-19 via this website: <https://coronavirus.utah.edu/>.

Other Policies and Resources

Math Tutoring Center: Please do not hesitate to come to office hours or contact me with any questions you have or to discuss anything about the course. Additionally, the T. Benny Rushing Mathematics Tutoring Center offers free online tutoring. The website can be found here: <https://www.math.utah.edu/undergrad/mathcenter.php>

Private Tutoring: The Learning Center has additional tutoring available for our class. Their website is <https://learningcenter.utah.edu>. The math department also maintains a list of private tutors.

Student Names and Personal Pronouns: Class rosters are provided to the instructor with the students' legal name as well as preferred first name (if previously entered by you in the Student Profile section of your CIS account). While CIS refers to this as merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you in class, on papers, exams, group projects, etc. Please advise me of any name or pronoun changes (and update CIS), so I can help create a learning environment in which you, your name, and your pronoun will be respected. If you need assistance getting your preferred name on your U-ID card, please visit the LGBT Resource Center Room 409 in the Olpin Union Building, or email bpeacock@sa.utah.edu to schedule a time to drop by. The LGBT Resource Center hours are M-F 8am-5pm, and 8am-6pm on Tuesdays.

Veterans Center: If you are a student veteran, the University of Utah has a Veterans Support Center located in Room 161 in the Olpin Union Building. Hours: M-F 8:00am – 5:00pm. Please visit their website for more information about what support they offer, a list of ongoing events and links to outside resources: <http://veteranscenter.utah.edu/>. Please also let me know if you need any additional support in this class for any reason.

Center for Student Wellness: Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., may interfere with a student's ability to succeed and thrive at the University of Utah. For helpful resources, contact the Center for Student Wellness: <https://wellness.utah.edu/>

The Americans with Disabilities Act: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, 801-581-5020, <https://disability.utah.edu/>. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access.

Addressing Sexual Misconduct: Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted on the basis of your sex, office for equal opportunity and affirmative action including sexual orientation or gender identity/expression, you are encouraged to report it to the University's Title IX Coordinator; Director, Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, <https://oeo.utah.edu/contact-us/index.php> or to the Office of the Dean of Students, 270 Union Building, 801-581-7066, <https://deanofstudents.utah.edu/>. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to police, contact the Department of Public Safety, 801-585-2677(COPS), <https://police.utah.edu/>.

Faculty and Student Responsibilities: All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know that they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty's responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee. See <http://regulations.utah.edu/academics/6-400.php>

Campus Safety: The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu

University Counseling Center: The UCC staff is committed to supporting the mental health needs of our campus community. Their phone number is 801-581-6826. Their hours are Monday-Friday, 8:00am-5:00pm. For after-hours emergencies, contact the 24/7 Crisis Line: 801-587-3000 . More information is at <https://counselingcenter.utah.edu/> .

Office of the Dean of Students: The Office of the Dean of Students is dedicated to being a resource to students through support, advocacy, involvement, and accountability. It serves as a support for students facing challenges to their success as students, and assists with the interpretation of University policy and regulations. To contact the Office of the Dean of Students, please email deanofstudents@utah.edu or call 801-581-7066. There is more information at <https://deanofstudents.utah.edu/> .

Important Dates:

We will meet for class every Monday, Wednesday, and Friday except for these days:

Monday, January 17 (Martin Luther King Jr. Day holiday)

Monday, February 21 (Presidents Day holiday)

Monday-Friday March 7-11 (Spring Break)

Wednesday, April 27 (Reading Day)

Last day to add, drop, elect CR/NC, or audit	Friday, January 21
Midterm 1	Friday, February 25
Last day to withdraw	Friday, March 4
Midterm 2	Friday, April 8
Last day to reverse Credit/No Credit	Friday, April 22
Final Exam	Tuesday, May 3

Tentative Schedule:

Jan. 10, 12, 14: 1.1 Sample Spaces and Probabilities; Appendix C Combinatorics; Start 1.2 Random Sampling

Jan. 19, 21: Finish 1.2; 1.3 Infinitely Many Outcomes; Start 1.4 Consequences of the Rules of Probability

Jan. 24, 26, 28: Finish 1.4; 1.5 First Look at Random Variables; Start 2.1 Conditional Probability

Jan. 31, Feb. 2, 4: Finish 2.1; 2.2 Bayes' Formula; 2.3 Independence

Feb. 7, 9, 11: 2.4 Independent Trials; 2.5 Further Topics on Sampling and Independence; 3.1 Probability Distributions of Random Variables

Feb. 14, 16, 18: 3.2 Cumulative Distribution Function; 3.3 Expectation

Feb. 23, 25: 3.4 Variance; Midterm 1

Feb. 28, Mar. 2, 4: 3.5 Gaussian Distribution; 4.1 Normal Approximation; 4.2 Law of Large Numbers; 4.4 Poisson Approximation

Mar. 7, 9, 11: Spring Break

Mar. 14, 16, 18: 4.5 Exponential Distribution; 5.1 Moment Generating Function; Start 5.2 Distribution of a Function of a Random Variable

Mar. 21, 23, 25: Finish 5.2; 6.1 Joint Distribution of Discrete Random Variables; 6.2 Jointly Continuous Random Variables

Mar. 28, 30, Apr. 1: 6.3 Joint Distributions and Independence; 7.1 Sums of Independent Random Variables; 8.1 Linearity of Expectation

Apr. 4, 6, 8: 8.2 Expectation and Independence; 8.3 Sums and MGFs; Midterm 2

Apr. 11, 13, 15: 8.4 Covariance and Correlation; Chapter 9 Estimating Tail Probabilities, Law of Large Numbers, Central Limit Theorem

Apr. 18, 20, 22: 10.1 Conditional Distributions of a Discrete Random Variable; 10.2 Conditional Distribution for Jointly Continuous Random Variables

Apr. 25: 10.3 Conditional Expectation

May 3: Final exam, 8:00-10:00am in JFB B-1

This is an approximate schedule, and I may need to adjust the pace for the learning needs of our class.