

# MATH 5010/6805-02: Introduction to Probability

## Summer 2020 Syllabus

**Time and Location:** Tuesday, Thursday 5:30-7:00 pm online through Zoom

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

**Email:** [sean@math.utah.edu](mailto:sean@math.utah.edu)

**Office Hours:** Online through Zoom,  
Tuesdays 4:30-5:30 pm,  
Thursdays 7:00-8:00 pm,  
after class Tuesdays or before class Thursdays most weeks,  
or by appointment

**Course Web Page:** I will post all course information and announcements on Canvas:  
<https://utah.instructure.com/courses/625367>

**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:

- Understand probability in terms of a sample space and construct a sample space to model a situation.
- Use combinatorial analysis to solve for probabilities.
- Calculate conditional probabilities and apply Bayes' Rule.
- Work with discrete and continuous random variables.
- Be fluent in several standard discrete and continuous probability distributions.
- Understand independence of events and random variables.
- Work with jointly distributed random variables.
- Calculate expected value and moments of a random variable.
- Understand the Law of Large Numbers and Central Limit Theorem and apply them.
- Continue using probability in further classes in Stochastic Processes (5040), Statistical Inference (5080), Math Finance (5760), and Actuarial Math (5030).

**Grading:** Grades will have the following weights and scale:

Homework	10%
Mini-Projects	20%
Midterm 1	20%
Midterm 2	20%
Final Exam	30%

[93, 100] A	[80, 83) B-	[67, 70) D+
[90, 93) A-	[77, 80) C+	[63, 67) D
[87, 90) B+	[73, 77) C	[60, 63) D-
[83, 87) B	[70, 73) C-	[0, 60) E

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, and 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. Answers will be made available so you can check your work, and I am always happy to discuss homework problems. Exam problems will often be similar to homework problems.

**Mini-Projects:** We will have a small project each week, except for weeks with an exam. 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. I will not generally accept these late, but I will drop the lowest score for each student at the end of the semester.

**Midterm Exams:** We will have two midterm exams, around June 11 and July 9. Each midterm will include material covered in class through the previous week. The midterms will be given online, and more details about the format will be available soon.

**Final Exam:** We will have a comprehensive final exam for this course during the Final Exam period July 30-31. The exam will be available online, and more details about the format will be available soon.

## Class Policies

- I will post announcements, messages, and grades on Canvas, so it is crucial 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 or exam, I ask that you please bring it to me within one week of it being returned. 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 on Canvas.

## 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 can be found here: <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](mailto: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/>

**ADA Statement:** 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 this class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, (801) 581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability Services.

**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, veterans status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801- 581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

**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>

**Safety Statement:** 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](http://safeu.utah.edu).

**Important Dates:**

Last day to add, drop, or audit .....	Wednesday, May 20
Midterm 1 .....	Around June 11
Last day to withdraw .....	Friday, June 19
Midterm 2 .....	Around July 9
Last day to elect Credit/No Credit .....	Wednesday, July 22
Final Exam .....	Around July 30-31

## **Tentative Schedule:**

**Week 1** 1.1 Sample Spaces and Probabilities; 1.2 Random Sampling; 1.3 Infinitely Many Outcomes; Combinatorics

**Week 2** 1.4 Consequences of the Rules of Probability; 1.5 First Look at Random Variables; 2.1 Conditional Probability

**Week 3** 2.2 Bayes' Formula; 2.3 Independence; 2.4 Independent Trials; 2.5 Further Topics on Sampling and Independence

**Week 4** 3.1 Probability Distributions of Random Variables; 3.2 Cumulative Distribution Function; 3.3 Expectation; 3.4 Variance

**Week 5** 3.5 Gaussian Distribution; 4.1 Normal Approximation; 4.2 Law of Large Numbers

**Week 6** 4.3 Applications of the Normal Approximation; 4.4 Poisson Approximation; 4.5 Exponential Distribution

**Week 7** 5.1 Moment Generating Function; 5.2 Distribution of a Function of a Random Variable; 6.1 Joint Distribution of Discrete Random Variables; 6.2 Jointly Continuous Random Variables

**Week 8** 6.3 Joint Distributions and Independence; 6.4 Transformations of Jointly Distributed Random Variables; 7.1 Sums of Independent Random Variables; 7.2 Exchangeable Random Variables

**Week 9** 8.1 Linearity of Expectation; 8.2 Expectation and Independence; 8.3 Sums and Moment Generating Functions

**Week 10** 8.4 Covariance and Correlation; 9.1 Estimating Tail Probabilities; 9.2 Law of Large Numbers; 9.3 Central Limit Theorem;

**Week 11** 9.4 Monte Carlo Method; 10.1 Conditional Distributions of a Discrete Random Variable; 10.2 Conditional Distribution for Jointly Continuous Random Variables

**Week 12** 10.3 Conditional Expectation; Review

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