

Syllabus
MATH 9010: Probability Theory I
Fall 2020, Section 001

Instructor: Brian H. Fralix

Instructor's Office: Martin O-310

Telephone Number and Email Address: (864) 656-5197, bfralix@clemson.edu

Office Hours: 4:30PM - 5:30PM MTWR

Course Location and Meeting Time: Godfrey 208, 12:20PM - 1:10PM MWF (and ONLINE)

All of our 'mathematical' lectures will take place asynchronously, through the use of videos that will be accessible to you within Canvas. Our 'in-person' synchronous sessions (which will also be recorded) will be used to (a) address questions you may have about the material, and (b) give each of you opportunities to present either additional course material, or solutions to problems to the class.

Course Web Site: All course information and materials (including your grades) will be stored in Canvas.

Textbooks: we will be making use of the following textbooks this semester:

- (Required) *A Probability Path* by Sidney Resnick.
- (Recommended) *Practical L^AT_EX* by George Grätzer.

Obviously Resnick's book is the important one for our purposes, but since you will be giving a few presentations this semester, you will find it useful to learn a little bit about L^AT_EX, and I will spend a few in-person lectures on L^AT_EX at the beginning of the semester (although I suspect many of you are familiar with it already). Both of these textbooks are Springer texts, and you can download them by going to the library web site, clicking on 'Databases', then 'SpringerLink'. Once you get to the SpringerLink site, search for each text.

Prerequisites: The official prerequisite for the course is MATH 8220 (Measure Theory) but we will be reviewing much of this material throughout the semester. You may be able to get away with only having MATH 4530 and MATH 4540, a probability course like MATH 4000 or MATH 8000, as well as a sufficiently high level of mathematical maturity. If you have not had MATH 8220, and are not sure if you want to try to receive a grade for MATH 9010, then you are welcome to audit the course.

Attendance Policy: I will keep track of your attendance through both our 'in-person' Zoom meetings, as well as through your Homework.

Late Instructor: If the instructor is late, students should wait 15 minutes before leaving.

Course Description: This course covers the basics of rigorous measure-theoretic probability theory. Topics include construction of probability measures, expectation, product measures and independence, convergence concepts and weak convergence, characteristic functions, the Law of Large Numbers, and the Central Limit Theorem.

Goals and Objectives: Upon completion of this course, students should be proficient in the following:

- Understanding the role played by various types of structured collection of sets ‘i.e. algebras, semialgebras, σ -algebras, π -systems, λ -systems, etc.’ within probability theory.
- Constructing probability measures on a collection of subsets of an uncountable state space
- Working with random variables by interpreting them as appropriately measurable functions on a probability space.
- Interpreting expected values of random variables as a form of abstract integration, and working with such abstract integrals in order to prove results, or derive quantities of interest.
- Understanding the different ways a sequence of random variables can converge to another random variable.
- Using truncation techniques to study the behavior of the sum of independent, identically distributed random variables.
- Understand how the Weak Law of Large Numbers, as well as the Strong Law of Large Numbers are proven, as well as the difference between the two.
- Using characteristic functions to show a sequence of random variables converges in distribution to a given random variable, the Central Limit Theorem being an example of a result that can be proven in this manner.
- Describing when random variables are independent, and understanding the link between independence and product measure.

Grading Policy: Your course grade will be based on both Homework Assignments (70 percent) as well as Course Presentations (30 percent). We will often use the ‘in-person’ synchronous lectures as an opportunity for you all to present either (a) additional material on a topic related to the course, or (b) solutions to certain problems from the homework assignments.

Your end-of-semester grades will be based on the following scale: $[90, 100] \rightarrow A$, $[85, 90) \rightarrow A-$, $[80, 85) \rightarrow B+$, $[70, 80) \rightarrow B$, $[65, 70) \rightarrow B-$, $[60, 65) \rightarrow C+$, $[55, 60) \rightarrow C$, $[50, 55) \rightarrow C-$ and $[0, 50) \rightarrow F$. The instructor has the right to curve grades upward if necessary.

Homework: Homework assignments will be announced in class, and will be sent to you via email.

Submitting Homework: Each homework assignment in this course will consist of a collection of problems for you to solve. You are welcome to collaborate with your classmates on the problems, but please state on your solutions anyone you collaborated with while writing up your solutions. You are also free to make use of whatever reference you want while working on each homework assignment, but please state if you made use of any other resources while writing up your solutions. Always make sure to first state the problem you are solving, then the solution, and make sure that each problem begins on a new page. I would prefer that you use L^AT_EX to write up your solutions, especially since you will be submitting them online, but I will accept scanned copies of handwritten solutions as well. **If you do not follow these guidelines on a given assignment, you will receive a grade of zero on that assignment.**

The point of adding this additional structure to the homework assignments is not to penalize you, but to help you realize how important it is to be able to communicate mathematical arguments effectively. If you have not noticed this yet, you will quickly find that taking time to make your arguments clear will greatly improve your understanding of mathematics.

Course Presentations: The Course Presentations are not meant to be intimidating, and are mainly there to give you practice with explaining complicated mathematical arguments to others, as well as practice in preparing to give a short academic talk. Given that essentially all of you are either PhD students, or plan to eventually become a PhD student, it is important that you practice this skill as much as possible. Again, you will want to use L^AT_EX to do this, in particular the Beamer package (we will talk more about this during our in-person lectures). Further details on how these will be graded will be given in class.

Official Statement of Academic Integrity: (*From the Graduate Announcements*) “As members of the Clemson University community, we have inherited Thomas Green Clemson’s vision of this institution as a ‘high seminary of learning.’ Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately and expeditiously to charges of violations of academic integrity.”

Disability Access Statement: “Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the professor know, and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848, by emailing studentaccess@lists.clemson.edu, or by visiting Suite 239 in the Academic Success Center building. Appointments are strongly encouraged – drop-ins will be seen if possible, but there could be a significant wait due to scheduled appointments. Students who receive Academic Access Letters are strongly encouraged to request, obtain and present these to their professors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student’s responsibility to follow this process each semester. You can access further information here: <http://www.clemson.edu/campus-life/campus-services/sds/>.”

Clemson University Title IX Statement: “Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran’s status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This policy is located at

<http://www.clemson.edu/campus-life/campus-services/access/title-ix/>.

Ms. Alesia Smith is the Clemson University Title IX Coordinator and the Executive Director of Equity Compliance. Her office is located at 110 Holtzendorff Hall, 864.656.3181 (voice) or 864.656.0899 (TDD).