Course Syllabus

STAT 559:
Measure Theory
Spring 2021

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Grader: Zhenman Yuan (yzhenman@uw.edu)

Course Website:
https://www.stat.washington.edu/people/fanghan/teaching/STAT559

Class Schedule: There will be two lectures a week:

• (Lecture) WF, 11:30-12:50 PM in https://washington.zoom.us/j/98939273140 (pwd: 559955).

Course Overview: This is a 10-week lecture-based course focused on introducing the very foundation of probability, the celebrated measure theory, which ends a hundreds-of-years debate of Bayesian vs. Frequentist. This course covers measure spaces, measurable functions over measure spaces, Lebesgue integration of measurable functions, product spaces and measure-theoretical Fubini’s theorem, measure-theoretical random variables, and lastly, modes of convergence and their implications in probability theory (particularly, law of large numbers and central limit theorem).

Prerequisites: This course requires either MATH 424 and MATH 425, or MATH 574 and MATH 575, and is appropriate for a graduate student of a mathematics/probability/statistics background, and requires a certain level of mathematical maturity. Please do not hesitate to approach the instructor if you have any concern.

Grades: There will be nine HWs (45%), one midterm (25%), and one final exam (30%). The final grade will be curved.

Format of HWs: There will be 9 homework assignments (each worth 5%). It will be out each Friday night and be due at the end of the next Friday (23:59:59). Late HWs will be penalized 20% per day (for instance, a homework turned in two days late will receive only 60% credit). Exceptions to these rules will of course be made for serious illness or other emergency circumstances; in these cases, please contact me as soon as you are aware of the problem. You need to upload your answers to the Canvas. Teamwork is allowed, but it is encouraged to think by yourself first; plagiarism is strictly forbidden. Technical correctness, clarity, and completeness are equally important.

Format of the exam: There will be a midterm and a final exam, both take-home and intended to be done in any 2-hour window, on May 07 and June 04. You will need to upload your answers to canvas. The exams will be open book, though neither access to the internet nor teamwork is allowed; they will be considered as cheating.

Course Textbook: This course is built on the first 8 chapters of the following lecture notes provided by Professor Sourav Chatterjee (a special thank to Sourav!)

• Sourav Chatterjee, Graduate Probability (Stats 310 series) https://statweb.stanford.edu/~souravc/stats310notes.pdf

Professor Galen Shorack’s book shall also be referenced from time to time


The following four books may also be referenced

Religious accommodations: “Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW’s policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/).”

Academic integrity: The University takes academic integrity very seriously. Behaving with integrity is part of our responsibility to our shared learning community. If you’re uncertain about if something is academic misconduct, ask me. I am willing to discuss questions you might have.

Acts of academic misconduct may include but are not limited to:

- Cheating (working collaboratively on quizzes/exams and discussion submissions, sharing answers and previewing quizzes/exams)
- Plagiarism (representing the work of others as your own without giving appropriate credit to the original author(s))

Concerns about these or other behaviors prohibited by the Student Conduct Code will be referred for investigation and adjudication by (include information for specific campus office).

Students found to have engaged in academic misconduct may receive a zero on the assignment (or other possible outcome).

Guidance to students taking courses outside the U.S.: Faculty members at U.S. universities – including the University of Washington – have the right to academic freedom which includes presenting and exploring topics and content that other governments may consider to be illegal and, therefore, choose to censor. Examples may include topics and content involving religion, gender and sexuality, human rights, democracy and representative government, and historic events.

If, as a UW student, you are living outside of the United States while taking courses remotely, you are subject to the laws of your local jurisdiction. Local authorities may limit your access to course material and take punitive action towards you. Unfortunately, the University of Washington has no authority over the laws in your jurisdictions or how local authorities enforce those laws.

If you are taking UW courses outside of the United States, you have reason to exercise caution when enrolling in courses that cover topics and issues censored in your jurisdiction. If you have concerns regarding a course or courses that you have registered for, please contact your academic advisor who will assist you in exploring options.

Course Schedule:
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<th>Content</th>
<th>Date (Fri.)</th>
<th>Content</th>
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<tr>
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<td>Introduction, motivation, set theory and measurable spaces</td>
<td>4/02</td>
<td>measure spaces, Dynkin’s theorem</td>
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<td>4/07</td>
<td>outer measures, starting Caratheodory</td>
<td>4/09</td>
<td>Caratheodory extension theorem, construction of (complete) Lebesgue measure</td>
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<td>4/14</td>
<td>Measurable function</td>
<td>4/16</td>
<td>Lebesgue integration</td>
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<td>4/21</td>
<td>MCT, Fatou, and DCT</td>
<td>4/23</td>
<td>MCT, Fatou, and DCT (cont.)</td>
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<td>4/28</td>
<td>Product spaces</td>
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<td>Fubini theorem</td>
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<td>5/05</td>
<td>L_p spaces</td>
<td>5/07</td>
<td>Midterm exam</td>
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<td>5/12</td>
<td>L_p spaces (cont.)</td>
<td>5/14</td>
<td>CDF and pdf, expectation, independence</td>
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<td>5/19</td>
<td>Four notions of convergence</td>
<td>5/21</td>
<td>Four notions of convergence (cont.)</td>
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<td>5/26</td>
<td>WLLN and SLLN</td>
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<td>central limit theorem</td>
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<td>6/02</td>
<td>central limit theorem (cont.)</td>
<td>6/04</td>
<td>Final exam</td>
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MCT: monotone convergence theorem  
DCT: dominated convergence theorem  
WLLN: weak law of large numbers  
SLLN: strong law of large numbers  
CLT: central limit theorem

Figure 1: Course schedule (tentative).