MA/STAT 539 - Probability Theory II
Fall 2015
MWF 8:30-9:20, Rec 123

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Office Hours: Monday 2:00-3:00, Wednesday 4:00-5:00

Supplementary material:
- Probability and Measure (3rd Edition), by Patrick Billingsley.
- A Modern Approach to Probability Theory, by Bert Fristedt and Lawrence Gray.

Course websites:
The main online forum for this course will be at piazza.com. On Piazza you can ask and answer
questions, find study partners, and view course announcements and documents. To enroll in our
course in Piazza go to
https://piazza.com/purdue/fall2015/ma539

The online gradebook for this course will be kept on Blackboard Learn.
https://mycourses.purdue.edu

Prerequisites: The general prerequisite for this course is MA/STAT 538 (Probability Theory I).
If you did not take MA/STAT 538, you should have the following background.

Real Analysis.
A basic understanding of measure theory (σ-fields, measurable sets/functions, Lebesgue inte-
gration, etc.) and the applications of measure theory in probability theory (probability spaces
as measure spaces, random variables, Carathéodory extension theorem, etc.)

Probability Theory.
Chapters 1-3 (through section 3.4) of the textbook were covered in MA/STAT 538 last
semester. In particular, you should be familiar with the weak and strong laws of large
numbers, the Borel-Cantelli lemmas, the different types of convergence (in probability, in
distribution, almost sure, Lp), characteristic functions, and the central limit theorem.

Course content: This is a second semester course in measure theoretic probability theory. The
core material for the course will consist of chapters 5 and 7 from the textbook.

Chapter 5 - Martingales
Conditional probabilities/expectations
Martingale convergence theorems
Martingale inequalities
Optional stopping

Chapter 7 - Ergodic theorems
Stationary sequences
Birkhoff’s Ergodic Theorem
Subadditive Ergodic Theorem
Other topics to be covered during the semester include the following (depending on available time):

- Exchangable sequences and DeFinneti’s Theorem
- Random walks (Chapter 4)
- Brownian motion (Chapter 8)
- Stable laws for sums of i.i.d. random variables (Section 3.7).

**Grading and Assignments:**

*Homework (40%)*

Homework will be assigned on a roughly bi-weekly basis. The homework assignments will be posted on the course website at piazza.com. Collaboration on homework assignments is allowed and in fact encouraged, but each student is expected to write up his/her own solution.

*Tests (30%)*

There will be one midterm exam during the semester accounting for 30% of the final grade for the course. The exam will be an evening exam, and the date of the exams will be announced at least 2 weeks in advance. If you have a conflict with the scheduled time of an exam you must contact me at least one week in advance.

*Final Exam (30%)*

The final exam will be cover the entire course. The date for the final exam is not yet determined.

**Homework instructions:** The homework problems are graded mainly on your reasoning. Part of doing good mathematics is showing your work in a way that is easy to understand. It is not the graders job to work hard to follow your work. *It is your responsibility to make your work easy to understand and follow.*

In addition, please follow these rules when handing in homework:
- Be neat. Recopy problems if necessary.
- Put in problems in the correct order.
- Staple your pages together, and don’t use paper torn out of a notebook.

**Disclaimers:**

- Cheating/plagiarization will not be tolerated. Any instances of suspected academic misconduct will be reported directly to the Dean of students.
- If you have a conflict with the test date, please let me know early enough so that I can schedule a make-up test or change the date of the test to a date that works for the class.