



EMORY

ROLLINS  
SCHOOL OF  
PUBLIC  
HEALTH

**DEPARTMENT:**

**COURSE NUMBER:**

**SECTION NUMBER:**

**CREDIT HOURS:** 4

**SEMESTER:** Fall 2020

**COURSE TITLE:** Probability Theory II

**CLASS HOURS AND LOCATION:** Grace Crum Rollins 115

**INSTRUCTOR NAME:** Limin Peng

### **INSTRUCTOR CONTACT INFORMATION**

EMAIL: lpeng@emory.edu

PHONE: 404-727-7701

SCHOOL ADDRESS OR MAILBOX LOCATION: Room 324, Grace Crum Rollins Building

**OFFICE HOURS:** Tuesday, 1-2pm

### **COURSE DESCRIPTION**

This course is a required course for the Emory PhD program in Biostatistics. It is designed as a mid-level theory course, which introduces classic distribution theory and large sample convergence on the basis of measure theory.

### **MPH/MSPH FOUNDATIONAL COMPETENCIES:**

#### **CONCENTRATION COMPETENCIES:**

- Use central concepts in statistical theory and inference
- Demonstrate technical accuracy with advanced analytic methods
- Develop new statistical theory and methods to address a broad range of complex medical or public health problems
- Teach statistical theory or methodology at all levels

#### **COURSE LEARNING OBJECTIVES:**

- To attain enhanced understanding of classical probability theory.
- To form a solid foundation in probability theory for independent biostatistical research.
- To be capable of teaching statistical theory or methodology at all levels.

## EVALUATION

- Homework: 30%
- Midterm Exam I: 20%
- Midterm Exam II: 20%
- Final Exam: 20%

## COURSE STRUCTURE

The students are expected to attend each lecture and complete each homework assignment. The below is a table showing the correspondence between BIOS competencies and course assessments.

BIOS Concentration Competencies assessed	Representative Assignment
Use central concepts in statistical theory and inference	Homework assignments 8-10 on large sample convergence, final exam
Demonstrate technical accuracy with advanced analytic methods	Homework assignments 1-7, midterm exams
Develop new statistical theory and methods to address a broad range of complex medical or public health problems	Final exam
Teach statistical theory or methodology at all levels	Homework

## COURSE POLICIES

- No late homework without instructor's permission is not acceptable.
- No textbook is required. The below are suggested reading materials and reference texts.

Reading materials:

1. Lecture notes by Professor Donglin Zeng at UNC-Chapel Hill.
2. Severini, T.A., Elements of Distribution Theory, Cambridge University Press, 2005.

Reference texts:

1. Rosenthal, J.S., A First Look at Rigorous Probability Theory, World Scientific Publishing, 2006, 2nd Edition.
2. Lehmann, E.L. and Casella, G., Theory of Point Estimation, 1998, 2nd Edition.
3. Ferguson, T.S. , A Course in Large Sample Theory, Chapman & Hall, 1996.

As the instructor of this course I endeavor to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me and the Office for Equity and Inclusion, 404-727-9877.

## **RSPH POLICIES**

### **Accessibility and Accommodations**

Accessibility Services works with students who have disabilities to provide reasonable accommodations. In order to receive consideration for reasonable accommodations, you must contact the Office of Accessibility Services (OAS). It is the responsibility of the student to register with OAS. Please note that accommodations are not retroactive and that disability accommodations are not provided until an accommodation letter has been processed.

Students who registered with OAS and have a letter outlining their academic accommodations are strongly encouraged to coordinate a meeting time with me to discuss a protocol to implement the accommodations as needed throughout the semester. This meeting should occur as early in the semester as possible.

Contact Accessibility Services for more information at (404) 727-9877 or [accessibility@emory.edu](mailto:accessibility@emory.edu). Additional information is available at the OAS website at <http://equityandinclusion.emory.edu/access/students/index.html>

### **Honor Code**

**You are bound by Emory University's Student Honor and Conduct Code.** RSPH requires that all material submitted by a student fulfilling his or her academic course of study must be the original work of the student. Violations of academic honor include any action by a student indicating dishonesty or a lack of integrity in academic ethics. *Academic dishonesty refers to cheating, plagiarizing, assisting other students without authorization, lying, tampering, or stealing in performing any academic work, and will not be tolerated under any circumstances.*

The RSPH Honor Code states: "Plagiarism is the act of presenting as one's own work the expression, words, or ideas of another person whether published or unpublished (including the work of another student). A writer's work should be regarded as his/her own property."  
([http://www.sph.emory.edu/cms/current\\_students/enrollment\\_services/honor\\_code.html](http://www.sph.emory.edu/cms/current_students/enrollment_services/honor_code.html))

## COURSE CALENDAR

August 30: first class

September 27: midterm exam 1

October 30: midterm exam 2

December 11: final exam

## COURSE OUTLINE

### Topics to be covered:

- Distribution theory (7 lectures)
  - Basic concepts and special distributions, algebra and transformation of random variable, moment generating functions, characteristic functions, multivariate normal distribution, families of distributions
- Measure, Integration and Probability (6 lectures)
  - Set theory, measure space, measurable function and integration, product of measures (Fubini-Tonelli Theorem), derivative of measures (Radon-Nikodym Theorem), probability measure, conditional probability, conditional expectation, and independence
- Large sample convergence (12 lectures)
  - $\epsilon$ - $\delta$  arguments, modes of convergence, convergence of transformations, limit theorems for summation of independent random variables, stochastic orders (big O and small o)