# Course Syllabus

## Course Information

**Course Prefix and Number:** Math 6263 A
**Credit Hours:** 3
**Instructor:** Vladimir Koltchinskii
**Email:** vlad@math.gatech.edu
**Semester:** Fall 2026

## Course Description

The main goal of the course is to develop a rigorous mathematical framework for the theory of hypotheses testing, including notions of optimality of statistical tests and asymptotic theory. The focus of the course is on mathematical aspects of hypotheses testing rather than on methodology or applications. The topics to be covered include:

1. Simple hypotheses testing and Neyman-Pearson Lemma.
2. Hellinger distance, consistency of Neyman-Pearson tests and minimax optimality.
3. Bayes optimal tests.
4. Sequential tests, Wald's Theorem.
5. Generalized Neyman-Pearson Lemma.
6. Composite hypotheses testing, uniformly most powerful and uniformly most powerful unbiased tests.
7. Large sample theory in testing, likelihood ratio tests and their asymptotics, Wilks' Theorem, Bahadur's slope of likelihood ratio tests.
8. Convex optimization in testing.
9. Combinatorial testing problems.

## Course Learning Outcomes

By enrolling in this course, students will:

1. Gain experience with designing theoretically optimal tests in the framework of simple, multiple and sequential testing.
2. Study various optimality concepts both in non-asymptotic and asymptotic frameworks.
3. Prepare themselves for reading advanced literature in mathematical statistics, machine learning and related areas dealing with hypotheses testing problems.

## Required Course Materials

No textbooks or materials are required. The following textbooks are recommended:

1. E.L. Lehmann and J.P. Romano, Testing statistical hypotheses, fourth edition, Springer, 2022.
2. A.W. van der Vaart, Asymptotic Statistics, Cambridge University Press, 2012.

Additional materials will be suggested on Canvas.

## Grading Policy

There will be two midterm exams (30% of the total score each) and the final exam (40% of the total score). The dates of the exams will be announced on Canvas by the first day of classes. The total score for three exams will determine the grade (A: 90%-100%, B: 80%-89%, C: 70%-79%, etc).

## Attendance Policy

Students are expected to attend the lectures. Attendance will be checked periodically. If you need to miss a class, please, let me know via email. If you miss a class more than twice without sending a note, your total score in the class will be reduced by 10 points, which could result in reducing your letter grade. If you audit the class, you do not need to take exams, but you still need to attend the class.

## Academic and Research Honesty/Integrity Statement

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review the Student Code of Conduct and the Academic Honor Code, especially Appendix A: Graduate Addendum to the Academic Honor Code.

Students are expected to perform research in an ethical and responsible manner. All Doctoral and Master's Thesis students are required to take the Responsible Conduct of Research training, and it is expected that students abide by the principles taught in that training while performing research.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Allegations of scientific or scholarly misconduct are handled in accordance with the procedures outlined by the Policy for Responding to Allegations of Scientific or Other Scholarly Misconduct.

## Core IMPACTS

Not applicable

## Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

## Student-Faculty Expectations

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulates some basic expectations that you can have of me and that I have of you. Additional information for research-related work is given in The Expectations of Advisors and Advisees. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.