STT 881: Theory of Probability, I
Fall Semester, 2009

Time and Place: M-W-F, 1:50–2:40; C102 Wells Hall

Instructor: Yimin Xiao, A-437 Wells Hall

Phone Number and E-Mail: 432-5411 xiao@stt.msu.edu

Office Hours: M W F 2:50–3:40PM, or by appointment.

Text: *Probability: Theory and Examples*, Third Edition, by Richard Durrett. Some supplementary materials will be given as we proceed.

Prerequisite: MTH 828 *Real Analysis*.

This course is the first of the series STT 881-882. The content of STT 881-882 includes measure and integration theory (review in nature), limit theorems for independent random variables and theory of stochastic processes. The objective of STT 881-882 is to lay a rigorous foundation on probability theory for graduate students who are interested in working in probability, statistics, analysis and related areas.

STT 881, in addition to a review of measure theory, covers limit theory of independent random variables. Some applications of probabilistic techniques in other areas will be mentioned. Specifically STT 881 will cover the following topics:

1. Review of measures and integration. Convergence theorems, L^p spaces and inequalities, the Lebesgue decomposition theorem, the Radon-Nikodym theorem, product measures and Fubini's theorem, Kolmorogov's extension theorem.

2. Independence and conditioning. Constructing independent random variables, Kolmogorov's zero-one law, the Borel-Cantelli lemma and its extensions, conditional expectations.

3. Law of large numbers. Convergence of random series, Cramér's large deviation theorem, law of the iterated logarithm.

4. Central limit theorems. Weak convergence, characteristic functions, the Lindeberg-Feller theorem, the Berry-Esseen theorem, stable laws, Poisson convergence.

5*. Martingales. Martingale convergence theorem, Doob's inequality, optional stopping theorem, applications.

The final grade is determined from homework assignments, and two exams (one in October and one in December).