

# MATH 567B/STAT567B: THEORETICAL STATISTICS-II FALL 2008

Tuesday, Thursday 2:00 – 3:15 OPTI 422

## COURSE INFORMATION

**INSTRUCTOR:** Rabi Bhattacharya

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**OFFICE HOURS:** Tuesday, Thursday 12:45- 1:45 & By Appointment

**TEXT:** *CLASS NOTES* [Copies made by the Fast Copy Service to be available at the Bookstore]

## COURSE CONTENTS

### PART I: LARGE SAMPLE THEORY OF ESTIMATION

1. Almost sure convergence, convergence in probability and convergence in distribution (or law); the classical CLT and the martingale CLT.
2. Consistency and asymptotic distribution of sample moments, quantiles, M-estimators; asymptotic relative efficiencies of estimators; autoregressive time series.
3. Cramer-Rao bounds and asymptotic efficiency of the MLE.
4. Asymptotic theory of Bayes estimators: Bernstein--von Mises Theorem.
5. Semi-parametric and nonparametric estimation: semi-parametric linear regression, functional estimation, nonparametric regression and density estimation.

### PART II: LARGE SAMPLE THEORY OF TESTS

6. Large sample theory of likelihood ratio and Wald's tests in parametric models; the chisquare tests for multinomials; tests for goodness of fit.
7. Nonparametric one- and two-sample tests: signed test, rank tests (Wilcoxon-Mann-Whitney), permutation tests.
8. Asymptotic relative efficiencies of tests (Pitman ARE).

### PART III: STATISTICAL COMPUTATION

9. Nonparametric bootstrap.
10. Markov Chain Monte Carlo and Bayes theory; hierarchical models.

PART IV: A SELECTION FROM THE FOLLOWING SPECIAL TOPICS

11. Categorical data and logistic regression.
12. Generalized linear models, mixture models.
13. Multiple testing and the false discovery rate (with biological applications).
14. Model validation.
15. Classification and statistical (machine) learning.
16. Kaplan-Meier product limit estimator in survival analysis.

**GRADING:** Grades are to be based on homework and a student project.