Syllabus on Probability and Statistics

Probability:

Random variable, Expectation, Independence

Variance and covariance, correlation, moment

Various distribution functions

Multivariate distribution

Characteristic function, Generating function

Various modes of convergence of random variables

Bayes formula, Conditional probability

Conditional expectation given a sigma-field

Laws of large numbers

Central limit theorems

Martingales

Markov chains

Basic properties of Poisson processes

Basic properties of Brownian motion

References:

Rick Durrett: Probability: Theory and Examples, Cambridge University Press, 2010

Kai-Lai Chung: A Course in Probability Theory, New York, 1968.

Statistics:

Distribution Theory and Basic Statistics

Families of continuous distributions: normal, chi-sq, t, F, gamma, beta; Families of discrete distributions: multinomial, Poisson, negative binomial; Basic statistics: sample mean, variance, median and quantiles.

Testing

Neyman-Pearson paradigm, null and alternative hypotheses, simple and composite hypotheses, type I and type II errors, power, most powerful test, likelihood ratio test, Neyman-Pearson Theorem, generalized likelihood ratio test.

Estimation

Parameter estimation, method of moments, maximum likelihood estimation, criteria for evaluation of estimators, Fisher information and its use, confidence interval.

Bayesian Statistics

Prior, posterior, conjugate priors, Bayesian estimator.

Large sample properties

Consistency, asymptotic normality, chi-sq approximation to likelihood ratio statistic.

References:

Casella, G. and Berger, R.L. (2002). Statistical Inference (2nd Ed.)

Duxbury Press.

茆诗松，程依明，濮晓龙，概率论与数理统计教程（第二版），高等教育出版社，2008.

陈家鼎，孙山泽，李东风，刘力平，数理统计学讲义，高等教育出版社，2006.

郑明，陈子毅，汪嘉冈，数理统计讲义，复旦大学出版社，2006.

陈希孺，倪国熙，数理统计学教程，中国科学技术大学出版社，2009.