The Statistics Department at The George Washington University will offer the following Graduate Courses in Fall 2006 (September 5 – December 22, 2006)

Enhance your statistical analysis skills by taking one or more of these courses. Registering as a non-degree student is easy - please visit www.gwu.edu/~regweb for relevant information.

For questions or further information please contact Dr. Tapan Nayak, e-mail: tapan@gwu.edu, ph: 202-994-6888.

Statistics 201-10. Mathematical Statistics. Thursday, 6:10pm-8:40pm. Instructor: Dr. S. Balaji.

Statistics 201-11. Mathematical Statistics. Monday, 6:10pm-8:40pm. Instructor: Dr. J. Wu.

This is the first part of a two-part graduate level series in Mathematical Statistics. The objective of the course is to introduce students to the concepts of probability that are useful for understanding statistical theory (the course continues on to Stat 202 in Spring, which deals with the theory of statistical inference). Topics to be covered in Stat 201 include basics of probability theory (including conditional probability, Bayes theorem, random variables, density and mass functions), univariate transformations, expected values, moment generating functions, common probability distributions (including binomial, normal, uniform), multivariate distributions and transformations, covariance, inequalities and sampling distributions. This is roughly chapters 1 through 5 of the text: *Statistical Inference* (2^{nd} Ed.) by Casella, G. and Berger, R. L.; Duxbury Press, CA.

This course is required for MS and Ph.D. students in Statistics, and Biostatistics, and Ph.D. students in Epidemiology. Students from other quantitative fields such as Economics, Finance, Engineering etc. would also find the course very useful and are encouraged to join. Prerequisites: Multivariable Calculus (Math 33), and Linear Algebra (Math 124) or equivalent.

Statistics 207. Methods of Statistical Computing I. Tuesday, 06:10pm-08:40pm. Instructor: Dr. R. Modarres.

The use of computational methods in the design and analysis of statistical algorithms will be explored. The course will cover topics in fundamentals of computer science, numerical analysis, and computer intensive methods. Fundamentals of computer science: data representation, primitive data structures, computer arithmetic and error analysis, list and non-linear data structures and algorithms, trees, and sorting techniques. Numerical analysis: function approximations, orthogonal polynomials, Edgeworth expansion, Cornish-Fisher inversion, and saddlepoint approximation, Lagrange interpolating polynomials, Newton-Cotes rules, Gaussian quadrature and multi-dimensional integrals. Computer intensive methods: random numbers, general techniques (PIT, method of mixtures, rejection method), techniques for members of the exponential family, discrete distributions (method of compounding, alias method), tail generation, generation of ordered values, and multivariate distributions and Cholesky decomposition.

Discussion of Monte Carlo simulation will include swindle and variance reduction techniques, stratified and importance sampling, control and antithetic variates, independent decomposition for estimating variances, and Monte Carlo regression. We will also cover jackknife and bootstrap, including bias and standard error of estimates, delete-d jackknife, exact bootstrap, EDF and the plug-in principle, parametric and nonparametric bootstrap, relationship between jackknife and bootstrap, percentile and other methods and hypothesis testing with the bootstrap. Permutation test of hypotheses for the one and the two sample problems, test of symmetry, and the permutation lemma will be covered. Other areas such as EM Algorithm and Markov Chain Monte Carlo will be discussed if time permits.

Prerequisites include knowledge of a programming language, a course in matrix algebra and mathematical statistics.

Textbooks: Statistical Computing, by W. J. Kennedy and J. E. Gentle and
An Introduction to the Bootstrap, by B. Efron and R. J. Tibshirani.

**Statistics 215. Applied Multivariate Analysis. Monday, 06:10pm-08:40pm.
Instructor: Dr. R. Modarres.**

This course is intended for students interested in statistical analysis of several variables, most likely dependent, following a joint normal distribution. It covers inferential and descriptive multivariate techniques, including the multivariate normal distribution, assessing the assumption of normality, transformations to near normality, Hotelling test for the mean vector, confidence regions and simultaneous comparisons of component means, missing observations and the EM algorithm and principal components analysis. In addition to the text, other topics from the literature, including some non-parametric techniques will be covered. For each technique, the theoretical foundation is developed and applied to observations from behavioral, social, medical, and physical sciences. The computational aspects will include use of matrix algebra tools (SAS/IML). Prerequisites include a course in matrix algebra and mathematical statistics.

Textbook: Applied Multivariate Analysis, 5th Ed., by R.A. Johnson and D.W. Wichern.

**Statistics 217. Design of Experiments. Wednesday, 6:10pm-8:40pm.
Instructor: Dr. E. Bura**

This course is a graduate level introduction to Design of Experiments, an area of statistics concerned with the planning of scientific investigation. The main components of an experimental design are the selection of the independent and dependent variables to be studied, determination of sample size, and allocation of experimental units to experimental treatments.

Specific topics which will be covered in detail include Replication, Blocking, Randomization, Factorial and Fractional -Factorial experiments, Repeated Measures designs, and Latin Square designs. Prerequisite: Stat 157-58; Math 124.

**Statistics 227. Survival Analysis. Monday, 06:10pm-08:40pm.
Instructor: Dr. Z. Li.**

This course will discuss parametric and nonparametric methods for the analyses of events observed in time (survival data). Topics include: survival distributions, Kaplan-Meier estimate of survival functions, Greenwood’s formula, Mantel-Haenszel test, logrank and generalized logrank tests, Cox proportional hazards model, parametric regression models, and power and sample size calculations for survival analysis.

Prerequisite: Stat 201-2 or permission of instructor.

Statistics 257. Probability. Wednesday, 06:10pm-08:40pm.
Instructor: Dr. H. Mahmoud

This course will discuss rigorous modern measure-theoretic probability. No prior knowledge of measure theory is assumed; the necessary concepts will be developed as necessary. Topics to be covered include: Sigma fields and Probability measures, Probability Axioms, Lebesgue integration and expectation, Measure-theoretic independence, Borel-Cantelli Lemmas, Modes of probabilistic convergence, Weak and strong laws of large numbers, and Central limit theorems.

Students wishing to move on to the next level of sophistication and mathematical maturity needed for study in fields such as stochastic processes, statistics or advanced applications will find this course useful. Prerequisite: Stat-201 (MS level course in probability).

Textbooks: Karr, A. (1993). *Probability*. Springer, New York.

Supplemental Texts: Chung, K. (1974). *A Course in Probability Theory*. Academic Press, Orlando. Billingsley, P. (1990). *Probability and Measure*, 2nd Edition. Wiley, New York.

Statistics 262. Nonparametric Inference. Thursday, 06:10pm-08:40pm
Instructor: Dr. S. Kundu.

This course will discuss inferential methods when the form of the underlying distribution is not specified or is only partially specified. These methods are robust as they do not rely on strong distributional assumptions. Topics to be covered in this course include: U-statistics, rank tests, locally most powerful rank tests, one and two-sample tests, asymptotic distribution theory, asymptotic relative efficiency, nonparametric point estimates and confidence intervals, goodness of fit tests. If time permits some advanced topics like Bootstrap, Nonparametric Density estimation, Nonparametric Regression will be covered.

Prerequisite: Stat 201-2 or permission of instructor.

Statistics 263. Advanced Statistical Theory I. Tuesday, 06:10pm-08:40pm.
Instructor: Dr. S. Bose.

This is an advanced course on principles and theory of statistical inference. Topics include: sufficiency, ancillarity, completeness, unbiased estimation, Cramer-Rao inequality, Bayesian estimation, admissibility, hypotheses testing.

Prerequisite: Stat 201-2 or permission of instructor.

Statistics 287. Modern Theory of Survey Sampling. Tuesdays, 6:10pm-8:40pm. Instructor: Dr. P. Chandhok

The main objectives of the course are to provide a rigorous treatment of sampling theory and its applications. With this background the student can modify the existing theory, develop new theory, and better understand its applications. Graduate students from quantitative fields such as Statistics, Mathematics, Economics, Finance and Engineering as well as professionals working in government and private-sector companies, with an interest in survey sampling will benefit from this course. The prerequisites for the class are Statistics 91 (Principles of Statistical Methods) or equivalent and Math 32 (Single-Variable Calculus) or equivalent.

This course will introduce the following topics: simple random sampling with and without replacement, systematic sampling, unequal probability sampling with and without replacement, ratio estimation, difference estimation and regression estimation.

Statistics 289. Reliability and Risk Analysis. Wednesday, 6:20pm-8:50pm. Instructor: Dr. N. Singpurwalla

The methods of reliability, life testing and survival analysis, provide an essential technology for risk analysis. The aim of this course is to provide an overview of this technology from a modern perspective, a perspective that encompasses many recent developments. These are to be summarized in a book that the instructor is developing and the course will be based on the material therein. Topics to be covered will be: an overview of the Bayesian paradigm for uncertainty quantification, exchangeability and its role in life testing and failure modeling, univariate and multivariate models for describing the failure of units and systems, interdependent (causal and cascading failures), life testing and information in life tests, the elicitation, codification and modulation of expert testimonies in reliability, signature analysis in survival data analysis, dynamic environments and the role of stochastic process models for competing risks, degradation modeling and failures characterized by multiple scales. The course will conclude with a discussion of the relevance of the above material to financial mathematics and financial risk analysis.

The course material should be of interest to those in risk analysis, in engineering reliability, biostatistics and survival analysis, quality control analysts, economists and those in mathematical finance.

Prerequisites: some background in probability and statistics and mathematical maturity.