

The Statistics Department at the George Washington University will offer the following graduate, and special topics undergraduate courses during Spring 2007 (January 16 – May 15, 2006) at the main campus.

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 pertinent information.

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

Undergraduate Courses:

**Stat 181: Applied Time Series Analysis. Tuesday, 6:10-8:40 pm.
Instructor: Dr. J. Wu**

What is the difference between a fortune teller with a crystal ball and a forecaster with knowledge of time series techniques? Find out by learning the basic theory and application of regression, exponential smoothing, and the autoregressive integrated moving average (ARIMA) modeling and forecasting of univariate time series. Frequency-domain techniques will also be discussed, including the estimation of spectral density functions and performing tests of white noise and hidden periodicities. SAS will be used to demonstrate numerical examples. Prerequisite: Math 33, Stat 157-8 or 118.

**Stat 197: Fundamentals of SAS Programming for Data Management. Thursday, 6:10-08:40 pm.
Instructor: Dr. R. Modarres**

This course is designed to introduce students to the fundamentals of the SAS system for data management, statistical analysis and report writing. Our goal is to provide a comprehensive understanding of and place emphasis on data modification, programming, file handling and macro writing. The course is divided into three unequal parts. The first part is devoted to the fundamentals of the SAS system. It provides an overview of the language, its capabilities, and weaknesses. The second part will concentrate on the Interactive Matrix Language. The third part of the course focuses on the components of the macro facility. Prerequisite: An introductory statistics course and Stat 129.

Graduate Courses:

**Stat 202-10: Mathematical Statistics. Thursday, 6:10-8:40pm.
Instructor: Dr. H. Mahmoud**

**Stat 202-11: Mathematical Statistics. Monday, 6:10-8:40pm.
Instructor: Dr. S. Balaji**

This is the second part of a two-part series in Mathematical Statistics. The objective is to familiarize students with the concepts of Mathematical Statistics at the graduate level. This course is a prerequisite for MS and Ph.D. students in Statistics and Biostatistics and Ph.D. students in Epidemiology. Graduate students from other related quantitative fields such as Economics, Finance, Engineering, etc. may also find this course very useful and are encouraged to join.

Stat 202 deals mostly with statistical inference (201 deals with probability theory). Topics to be covered include sampling distributions (including Central Limit Theorem), data reduction (including sufficiency, ancillarity and completeness), point estimation (including method of moments, maximum likelihood and Bayes estimation), properties of point estimators (including unbiasedness, minimum variance, efficiency, Cramer-Rao inequality), hypotheses testing (including likelihood ratio and Bayesian tests, Neyman Pearson Lemma, power and size of a test, p-value of a test), interval estimation (including Bayesian HPD intervals, intervals obtained through inversion of a test statistic or from a pivotal quantity) and asymptotic properties of procedures (including consistency and efficiency of estimators, large-sample confidence intervals, asymptotic distribution of likelihood ratio tests). This is roughly chapters 5-10 of the text: Statistical Inference by Casella and Berger (2nd ed.). Prerequisite: Multivariable Calculus (Math 33), Linear Algebra (Math 124) and Stat 201 or equivalent.

Stat 210: Data Analysis. Monday, 6:10-8:40pm.

Instructor: Dr. P. Bonangelino

This course will review statistical principles of data analysis using computerized statistical analysis procedures provided by the Statistical Analysis System (SAS). Specific topics include: graphical displays (density estimation), univariate analyses, multiple regression, collinearity diagnostics, influence diagnostics, data-dependent model biases, analysis of contingency tables and categorical data, logistic regression for qualitative responses, analysis of variance and covariance, and the general linear model. Each week will present a statistical method and sample analyses presented in SAS listings. Each week a data analysis project will be assigned requesting that specific statistical analyses be performed and that the results be presented and interpreted in a typed statistical report. There will be a final exam and each student will also be required to complete an independent data analysis project. Prerequisites: 1) Stat 118, 2) either Stat 157 or 201, and 3) Stat 183 or equivalent or proficiency with SAS.

Stat 213: Intermediate Probability & Stochastic Processes. Wednesday, 6:10-8:40 pm.

Instructor: Dr. Z. Li

Topics include: Random variables and their distribution; Conditional distribution and conditional expectation; Convergence of random variables: almost surely, in probability, in r th mean, in distribution; Probability inequalities: Markov inequality, Cauchy-Schwartz inequality, Jensen's inequality; Branching process, Poisson process, Brownian motion, martingale theory. Prerequisites: Stat 201-2 or equivalent.

Textbook: Probability and Random Processes by G. R. Grimmett and D. R. Strizaker.

**Stat 216: Applied Multivariate Analysis. Tuesday, 6:10-8:40pm.
Instructor: Dr. R. Modarres**

This is the second part of a two-semester sequence in Applied Multivariate Analysis. The course is designed to introduce students to statistical analyses of several variables, most likely dependent, following a joint normal distribution. Topics include, comparisons of several population means, multivariate linear regression models, principal components, factor analysis, inference for structured covariance matrices, canonical correlations, discrimination and classification, clustering and distance methods. Additional topics from the literature will also be covered. There will be many applications of these multivariate techniques to analyses of data from the 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. The textbook is Applied Multivariate Analysis, 5th Ed., by R.A. Johnson and D.W. Wichern.

**Stat 218: Linear Models. Wednesday, 6:10-8:40pm.
Instructor: Dr. E. Bura**

This introductory one-semester course in Linear Models is designed for graduate students in Statistics, but students from other fields such as Economics, Finance, Sociology, Psychology, and Engineering would find it very useful.

This course concentrates on development of the basic theory for regression, analysis of variance, analysis of covariance and extensions of these such as generalized linear models. This course covers theoretical aspects as well as applied problems in linear models. Topics to be covered include review of matrix algebra, random vectors and matrices, multivariate normal distribution, distribution of quadratic forms, simple and multiple regression: Estimations and Hypothesis testing, Model validation and diagnostics, Analysis of Variance: One way models, Two way models, unbalance data, Analysis of covariance and generalized linear models.

Prerequisites: Calculus, matrix algebra, and some exposure to statistical theory (STAT 201-2).

Textbook: Linear Models in Statistics by Alvin C. Rencher. Wiley 2000, ISBN 0-471-31564-8

**Stat 223: Bayesian Statistics: Theory and Applications. Tuesday, 6:10-8:40pm.
Instructor: Dr. S. Bose**

This course will provide an overview of Bayesian theory, methods, and applications, starting with a discussion of why one would use Bayesian methods. Topics include foundational issues -- the likelihood principle and the Bayesian approach, conjugate

priors and non-informative priors, Bayesian estimation, Bayesian testing of hypotheses and the Bayes factor, Bayesian linear models, robustness of Bayesian analyses, and computational issues. Prerequisite: Stat 201-202.

Stat 258: Distribution Theory. Monday, 6:10-8:40pm.
Instructor: Dr. H. Mahmoud

The course builds a bridge between probability theory and its application in statistics by providing the student with a repertoire of techniques of distribution theory that receive wide applications in statistics. The course is beneficial to students wishing to move on to the next level of sophistication and mathematical maturity needed for advanced study in any of the fields of stochastic processes, probability theory, or statistics. Prerequisite: Master's level background in probability and statistics. Background in measure-theoretic probability is helpful but not required.

Topics include: moments and cumulants; characteristic and moment generating functions; specialized probability inequalities, the empirical distribution Lorenz curve; asymptotic theory – the delta method, extreme value theory; order statistics and spacing and some estimators and tests based on them.

Textbooks: Stuart, A. and Ord, K. (1987). *Advanced Theory of Statistics, Vol. I Distribution Theory*, Oxford University Press, and David, H. (1981). *Order Statistics*.

Reference texts: Sarfling, R.J. (1980). *Approximation Theorems of Mathematical Statistics*, Wiley, New York; C. R. Rao (1973). *Linear Statistical Inference and Its Applications*; Wilks, S. (1962). *Mathematical Statistics*. Princeton University Press, Princeton, New Jersey; Arnold B., Balakrishnan, N., and Nagarajah, H. (1992). *A First Course in Order Statistics*. Wiley, New York.

Stat 281: Advanced Time Series Analysis. Thursday, 6:10-8:40pm.
Instructor: Dr. N. Singpurwalla

In general, any data that is generated over time, constitutes a time series, and the analyses of such data occupy a central position in a statistician's toolkit. Time series data constitute the realization of a stochastic process, and such processes have proven to be germane to a wide spectrum of arenas such as: astronomy, biology, and economics, environmetrics, engineering, finance, marketing, medicine, operations research, physics, and sales, to mention a few.

The aim of this course is two-fold. The first is to develop a theoretical framework via which regression, time series analysis, and forecasting can be comprehensively viewed in a unifying manner. To do so, we start with some foundational material on the quantification of uncertainty leading to the notion of a probability model. The models of regression and time series analysis are special cases, and specific examples are the ARIMA and the dynamic linear model (DLM). Particular emphasis will be attached to the techniques of filtering, smoothing and extrapolations using the Kalman Filter, a

special case of the DLM. Also discussed will be aspects of the control of stochastic processes via the principle of utility maximization – to engineers “control theory”.

The course will emphasize concepts, principles, ideas, and techniques; the methodology will be reinforced via case studies and applications from the student.

Textbook: Lecture notes developed (in progress) by the instructor, and reading material from key papers and books.

Stat 289: Statistical Genetics. Thursday, 6:10-08:40pm
Instructor: Dr. Z. Li.

There are three objectives of this course: 1) to provide an introduction of quantitative genetics for students without any genetics background; 2) to give a rigorous statistical treatment of some genetic problems; 3) to introduce current research topics in the area of statistical methods for genetic analysis.

Topics include: Allele frequency, Hardy-Weinberg equilibrium, and linkage equilibrium; Genetic variance and correlation; Parametric linkage analysis; Non-parametric linkage analysis; Recurrence-risk ratio method; The transmission/disequilibrium test (TDT); Family-based case control vs. unrelated case-control designs; Multiple point linkage analysis; Interval mapping; Haplotype-based association analysis.