Georgetown University
Department of Mathematics
Master of Science in Mathematics and Statistics

Courses for Spring 2007

In the Spring of 2007, the department will offer the following three credit courses:

- Math-503 (Mathematical Statistics)
- Math-504 (Numerical Methods)
- Math-605 (Intro to Financial Mathematics)

In addition, Math-701 (Statistical Consulting Practicum, 2 credits) and Math-702 (Applied Mathematics Clinic, 2 credits) will be offered.

Spring Schedule at a Glance

Course	Title	Instructor	Time	Place
Math-503	Mathematical Statistics	Sellers	R 5:40-8:10	St. Mary's 110
Math-504	Numerical Methods	Gilsinn	T 5:40-8:10	St. Mary's 333
Math-605	Intro to Financial Math	Eller	W 5:40-8:10	Reiss 264
Math-701	Stat Consulting Practicum	Engler	TBA	3rd Floor St. Mary's
Math-702	Applied Math Clinic	TBA	TBA	TBA

All times are approximate and subject to minor changes.
In addition, the Biostatistics and Epidemiology graduate program will offer BIST-512 (Statistical Modeling I), BIST-531 (Pattern recognition), and BIST-541 (Principle of Epidemiology).

Students enrolled at other area universities may register for these courses through the Consortium of Universities of the Washington Metropolitan Area at http://www.consortium.org . The program's website is at http://www.math.georgetown.edu/grad/main.htm.

Course Descriptions

Math-503: Mathematical Statistics. This is a first course in the mathematical theory of statistical inference. The emphasis is on frequentist methods, with appropriate attention also to Bayesian methods. Statistical software (SAS) will be used in the second half of the course. Topics include principles of data reduction (sufficiency and sufficient statistics, likelihood, invariance), construction of point estimates (method of moments, maximum likelihood, Bayes estimators), criteria for point estimation (mean squared error, unbiasedness, consistency), construction of hypothesis tests (likelihood ratio, invariance, Bayesian tests), some asymptotic properties of point estimators, criteria for hypothesis tests (error probabilities and power, most powerful tests, bias), asymptotics of some large sample tests, construction of interval estimates (using a test statistic, pivotal quantities, Bayesian intervals, invariance), criteria for interval estimates (coverage probability, optimality), elements of decision theory and applications to statistical inference (Bayes rules, minimax), elements of the analysis of variance (one-way ANOVA, F-test, contrasts), elements of linear regression (least squares, tests for model parameters, pointwise and simultaneous estimation and prediction. If time permits: More on asymptotic of estimators, exact and approximate tests for contingency tables, some nonparametric tests (sign test, rank sum test), more on ANOVA.

The course will use Hogg/McKean/Craig, Introduction to Mathematical Statistics, 6th edition. Additional References: Casella/Berger, Statistical Inference, chapters 6-12 and Bickel/Doksum, Mathematical Statistics: Basic Ideas and Selected Topics, Vol. I (2nd Edition), starting at chapter 2.

Prerequisites: Calculus of one and several variables, some linear algebra (matrix algebra), Math-501 (Probability Theory).

Math-504: Numerical Methods. This course concerns the design and analysis of computational algorithms and techniques for solving a variety of mathematical problems. This course will provide the insight and theory behind scientific and engineering computing. The topics covered in this course includes solving nonlinear equations; numerical linear algebra and solving systems of linear equations; approximation and interpolation using Lagrange polynomials, least square polynomials and splines; numerical differentiation and integration; solving ordinary differential equations; and simulation of stochastic processes. We will also discuss issues associated with computer arithmetic, such as floating-point number representations, roundoff errors, and stability of computations, as well as error analysis and convergence of numerical schemes.

Students who take this course are expected to have background in multivariable calculus, linear algebra and differential equations. Some knowledge in one computer programming language is required.

The main text for the course will be Numerical Methods (3rd edition) by Tim Sauer. Optional: Charles Van Loan, Introduction to Scientific Computing.

Math-605: Introduction to Financial Mathematics. This course will cover (i) financial derivatives, such as stock options, forwards and futures,(ii) market models and the concept of arbitrage, (iii) probability theory and Brownian motion, (iv) stochastic differential equations, (v) the Black-Scholes theory of option pricing.

Prerequisites: Solid background in Multivariable Calculus and Linear Algebra, and some basic knowledge of probability theory and differential equations.

Lecture notes and course material will be made available on the Blackboard web site for the course.