COURSE ANNOUNCEMENT

550.111 Statistical Analysis I

Spring 2009

First semester of a general survey of statistical methodology. Topics include descriptive statistics, probability models, random variable, expectation, sampling, the central limit theorem, classical and robust estimation of location, confidence intervals, hypothesis testing, two-sample problems, introductory analysis of variance, introductory nonparametric methods. Three lectures and a conference weekly. Some use of computing with the Minitab statistical package, but prior computing experience not required.

Prerequisites: Four years of high school math.

Text: Anderson, Statistics For Business +Econ.-w/CD, 2008. 10th ed.

Time: MWF 1:30 – 2:20
Section 01: W 4:30
Section 02: Th 9
Section 03: Th 10:30
Section 04: Th 12
Section 05: Th 1:30

Instructor:
Nam Lee
212B Whitehead Hall
410-516-7596
nlee38@jhu.edu

COURSE ANNOUNCEMENT

550.112 Statistical Analysis II

Spring 2009

Second semester of a general survey of statistical methodology. Topics include least squares and regression analysis, correlation, further nonparametric meethods, chi-square tests, the likelihood concept, decision theory, Bayseian inference, time series, simultaneous equations, sample survey design. Students who may wish to undertake more than two semesters of probability and statistics should consider 550.420-550.430.

Prerequisites: 550.111

Text: McClave & Sincich, Statistics, 10th ed., Prentice Hall

Time: MWF 12
Section 01: Th 9
Section 02: Th 10:30
Section 03: Th 12
Section 04: Th 1:30

Instructor: Fred Torcaso
211B Whitehead Hall
410-516-4160
torcaso@ams.jhu.edu

COURSE ANNOUNCEMENT

550.122 Chance and Risk

Spring 2009

The course will help students develop an appreciation of probability and randomness, and an understanding of its applications in real life situations involving chance and risk. Applications, controversies, and paradoxes involving risk in business and economics, health and medicine, law, politics, sports and gambling will be used to illustrate probabilistic concepts such as independence, conditional probability, expectation, and variance. The course is intended primarily for humanities and social science majors. There is no prerequisite beyond high school mathematics.

Prerequisites: High school mathematics

Text:

Time: MWF 10
Section 01: T 9
Section 02: T 10:30

Instructor:

Anant Godbole
306E Whitehead Hall
410-516-3460
agodbol1@jhu.edu

COURSE ANNOUNCEMENT

550.150 Introduction to Contemporary Applied Mathematics

Spring 2009

A survey course aimed at developing, in an accessible way for non-mathematicians, an appreciation for practical mathematical thinking, while exposing students to various ways in which mathematics is used to solve real-world problems. The course presents topics from a variety of application areas, including management science, statistics and data analysis, information coding and transmission, social choice and decision making, and the study of size and shape.

Prerequisites:

Text:

Time: MWF 11
Section 01: T 3
Section 02: T 4:30

Instructor:
Beryl Castello
200 Whitehead Hall
410-516-7579
castello@ams.jhu.edu

COURSE ANNOUNCEMENT

550.171 Discrete Mathematics

Spring 2009

Introduction to the mathematics of finite systems. Logic, boolean algebra, induction and recursion, sets, functions, relations, equivalence and partially ordered sets; elementary combinatorics; modular arithmetic and the Euclidean algorithm; group theory; permutations and symmetry groups; graph theory. Selected applications. The concept of a proof and development of the ability to recognize and construct proofs are part of the course.

Prerequisites: 4 years high school math

Text: Edward Scheinerman, Mathematics: A Discrete Introduction, Brooks Cole

Time: MWF 10
Section 01: Th 1:30
Section 02: Th 9

Instructor:
Fred Torcaso
211B Whitehead Hall
410-516-4160
torcaso@ams.jhu.edu

COURSE ANNOUNCEMENT

550.251 Mathematical Models for Decision Making: Deterministic Models

Spring 2009

This course is an introduction to management science and the quantitative approach to decision making. Our focus will be on deterministic models, in which we assume that all problem parameters are known with certainty. The covered topics may include Linear and Integer Programming, Network Models, Inventory Models (Stationary Demand), Nonlinear Programming, Goal Programming, and Ordinary Differential Equations. We emphasize model development and case studies, using spreadsheets and other computer software. The applications we study occur in manufacturing and transportation systems, as well as in finance and general management.

Prerequisites: One semester of Calculus.

Text: Practical Management Science, W.L.. Winston & S.C. Albright, 3rd ed., Thomson South-Western.

Time: MWF 1:30
Section 01: Th 1:30
Section 02: Th 3

Instructor: Beryl Castello
200 Whitehead Hall
410-516-7579
castello@ams.jhu.edu

COURSE ANNOUNCEMENT

550.291 Linear Algebra and Differential Equations

Spring 2009

An introduction to the basic concepts of linear algebra, matrix theory, and differential equations that are used widely in modern engineering and science. This course is intended for engineering and science majors whose programs does not permit taking both 110.201 and 110.302.

Prerequisites:	One year of Calculus, computing experience.
Text:	Edwards and Penney, Differential Equations and Linear Algebra, 3rd ed. Prentice Hall
Time:	MWF 9 Section 01: T 1:30 Section 02: T 3
Instructor:	Youngmi Hur 212C Whitehead Hall 410-516-7914 hur@jhu.edu

COURSE ANNOUNCEMENT

550.310 Probability & Statistics for the Physical and Information Sciences and Engineering

Spring 2009

Students cannot recieve credit for both 550.310 and 550.311. An introduction to probability and statistics at the calculus level, intended for engineering and science students planning to take only one course on the topics. This course will be at the same technical level as 550.311. Students are encouraged to consider 550.420-430 instead. Combinatorial probability, independence, conditional probability, random variables, discrete and continuous probability models, expectation and moments, central limit theorem, estimation, confidence intervals, hypothesis testing, tests of means and variances.

Prerequisites: One year of calculus. Recommended corequisite: multivariable calculus

Text: Jay DeVore, Probability and Statistics for Engineering and the Sciences, 6th ed., Duxbury

Time: MWF 11
Section 01: T 1:30
Section 02: T 3
Section 03: T 4:30

Instructor:
Bruno Jedynak
208B Whitehead Hall
410-516-7341
bruno.jedynak@jhu.edu

COURSE ANNOUNCEMENT

550.311 Probability & Statistics for the Biological Sciences and Engineering

Spring 2009

An introduction to probability and statistics at the calculus level, intended for students in the biological sciences planning to take only one course on the topics. This course will be at the same technical level as 550.310. Students are encouraged to consider 550.420-430 instead. Combinatorial probability, independence, conditional probability, random variables, discrete and continuous probability models, expectation and moments, central limit theorem, estimation, confidence intervals, hypothesis testing, tests of means and variances, goodness-of-fit will be covered.

Prerequisites: One year of calculus. Recommended: 110.202

Text: Jay DeVore, Probability and Statistics for Engineering and the Sciences, 6th ed., Duxbury

Time: MWF 10
Section 01: T 1:30
Section 02: T 3

Instructor:
Donniell Fishkind
Whitehead 304 B
410-516-7828
fishkind@ams.jhu.edu

COURSE ANNOUNCEMENT

550.362 Introduction to Optimization II

Spring 2009

An introductory survey of optimization methods, supporting mathematical theory and concepts, and application to problems of planning, design, prediciton, estimation, and control in engineering, management and science. Study of varied optimization techniques include linear programming, network-problem methods, dynamic programming. Appropriate for undergraudate and graduate students without mathematical background required for 550.661.

Prerequisites:	550.361 and multivariable calculus
Text:	Introduction to Mathematical Programming, 4th ed., Winston & Venkataramanan, Brooks/Cole
Time:	MWF 12 Section 01: Th 3
Instructor:	Beryl Castello 200 Whitehead Hall 410-516-7579 castello@ams.jhu.edu

COURSE ANNOUNCEMENT

550.371 Cryptology and Coding

Spring 2009

A first course in the mathematical theory of secure and reliable electronic communication. Cryptology is the study of secure communication: How can we ensure the privacy of messages? Coding theory studies how to make communication relable: How can messages be sent over noisy lines? Topics include finite field arithmetic, error-detecting and error-correcting codes, data compressions, ciphers, one-time pads, the Enigma machine, one-way functions, discrete logarithm, primality testing, secret key exchange, public key cryptosystems, digital signatures, and key escrow.

Prerequisites: 550.171

Text:

Time: MWF 12
Section 01: Th 10:30

Instructor: Donniell Fishkind
Whitehead 304 B
410-516-7828
fishkind@ams.jhu.edu

COURSE ANNOUNCEMENT

550.386 Scientific Computing: Differential Equations

Spring 2009

A first course on computational differential equations and applications. Topics include floating point arithmetic, algorithms and convergence, root finding (midpoint, Newton and secant methods), numerical differentiation and integration, and numerical solution of initial value problems (Runge-Kutta, multistep, extrapolation methods, stability, implicit methods and stiffness). Theoretical topics such as existence, uniqueness and stability of solutions to initial-value problems, conversion of higher-order/non-autonomous equations to systems, etc. will be covered as needed. Matlab is used to solve all numerical exercises; no previous experience with computer programming is required.

Prerequisites:	Calculus III and 550.291 or approved alternative (ex. 110.201)
Text:	TBA
Time:	MWF 9 Section 01: Th 10:30
Instructor:	Greg Eyink 202D Whitehead Hall 410-516-7201 eyink@ams.jhu.edu

COURSE ANNOUNCEMENT

550.400 Mathematical Modeling and Consulting

Spring 2009

Formulation, analysis, interpretation, and evaluation of mathematical models. Synthesis of ideas, techniques, and models from mathematical sciences, science, and engineering. Case studies to illustrate basic features of the modeling process. Project-oriented practice and guidance in modeling techniques, research techniques, and written and oral communication of mathematical concepts.

The focus of this version of the course is on applied statistics, that is, using statistics to solve real-world problems. The R statistical package will be introduced. No previous knowledge of computing is necessary.

Note: This course can be used to satisfy computing requirement for undergraduate majors.

Prerequisites: 550.310, 550.311, or 550.420

Text:

Time: MWF 11
Section 01: T 3

Instructor:
Daniel Naiman
Whitehead 202C
410-516-7203
daniel.naiman@jhu.edu

COURSE ANNOUNCEMENT

550.426 Introduction to Stochastic Processes

Spring 2009

Mathematical theory of stochastic processes. Emphasis on deriving the dependence relations, statistical properties and sample path behavior including random walks, Markov chains (both discrete and continuous time), Poisson processes, martingales and Brownian motion. Applications that illuminate the theory.

Prerequisites:	550.420 Introduction to Probability
Text:	Sheldon Ross, Stochastic Processes, 2nd edition, Wiley, 1996
Time:	MW 4:30 – 5:45 Section 01: F 10
Instructor:	Fred Torcaso 211B Whitehead Hall 410-516-4160 torcaso@ams.jhu.edu

COURSE ANNOUNCEMENT

550.430 Introduction to Statistics

Spring 2009

Sec. 01 - Meant for undergraduates, Sec. 02 - Meant for graduates. An introduction to the basic principles of statistical reasoning and data analysis. Emphasis on techniques of application. Classical parametric estimation, hypothesis testing, and multiple decision problems; linear models, analysis of variance, and regression; non paramentric and robust procedures; decision-theoretic setting, Bayesian methods.

Prerequisites:	550.420 or approved alternative
Text:	John A. Rice, Mathematical Statistics and Data Analysis, 3nd Edition, Duxbury
Time:	MWF 1:30 – 2:20 Section 01: Th 1:30 Section 02: Th 3 Section 03: Th 4:30
Instructor:	Bruno Jedynak 208B Whitehead Hall 410-516-7341 bruno.jedynak@jhu.edu

COURSE ANNOUNCEMENT

550.439 Time Series Analysis

Spring 2009

Time series analysis from the frequency and time domain approaches. Descriptive techniques; regression analysis; trends, smoothing, prediction; linear systems; serial correlation; stationary processes; spectral analysis.

Prerequisites:	550.310, 550.311, or equivalent calculus-based probability course, 110.201 or 550.291, and mathematical maturity
Text:	Wei, *Time Series Analysis*, 2006, 2nd ed.
Time:	MWF 10
Instructor:	Nam Lee 212B Whitehead Hall 410-516-7596 nlee38@jhu.edu

COURSE ANNOUNCEMENT

550.445 Modeling and Analysis of Securities and Financial Markets II

Spring 2009

Advances in corporate finance, investment practice and the capital markets have been driven by the development of a mathematically rigorous theory for financial instruments and the markets in which they trade. This course will develop the mathematical concepts and techniques for modeling markets introduced in 550.444. In addition to new topics in credit enhancement and structured securities, the focus is expanded to include applications in portfolio theory and risk management, and covers some numerical and computational approaches.

Prerequisites: 550.420, 550.444 or permission of instructor

Text: John C. Hull: Options, Futures, and Other Derivatives, Prentice-Hall, (7e) 2005

Time: MW 12 - 1:15
Section 01: F 12

Instructor:
David Audley
212A Whitehead Hall
410-516-7136
daudley@ams.jhu.edu

COURSE ANNOUNCEMENT

550.448 Financial Engineering

Spring 2009

This course focuses on structured securities and the structuring of aggregates of financial instruments into engineered solutions of problems in capital finance. Topics include the fundamentals of creating asset-backed and structured securities – including mortgage-backed securities (MBS), stripped securities, collateralized mortgage obligations (CMOs), and other asset-backed collateralized debt obligations (CDOs) – structuring and allocating cash-flows as well as enhancing credit; equity hybrids and convertible instruments; asset swaps, credit derivatives and total return swaps; assessment of structure-risk interest rate-risk and credit-risk as well as strategies for hedging these exposures; managing portfolios of structured securities; and relative value analysis (including OAS and scenario analysis).

Prerequisites: 550.442 or 550.444 or instructor's permission

Text: TBA

Time: MW 3 - 4:15
Section 01: F 3

Instructor: David Audley
212A Whitehead Hall
410-516-7136
daudley@ams.jhu.edu

COURSE ANNOUNCEMENT

550.472 Graph Theory

Spring 2009

Study of systems of 'verticies' with some pairs joined by 'edges.' Theory of adjacency, connectivity, traversability, feedback, and other concepts underlying properties important in engineering and the sciences. Topics include paths, cycles and trees; routing problems associated with Euler and Hamilton; design of graphs realizing specified incidence conditions and other constraints. Attention directed toward problem solving, algorithms and applications. One or more topics taken up in greater depth.

Prerequisites: Linear Algebra

Text: D.B. West, Introduction to Graph Theory, 2nd Edition

Time: MWF 9
Section 01: Th 3

Instructor: Donniell Fishkind
Whitehead 304 B
410-516-7828
fishkind@ams.jhu.edu

COURSE ANNOUNCEMENT

550.621 Probability Theory II

Spring 2009

Probability at the level of measure theory, focusing on limit theory. Modes of convergence, Poisson convergence, three-series theorem, strong law of large numbers, continuity theorem, strong law of large numbers, continuity theorem, central limit theory, Berry-Esseen theorem, infintely divisible and stable laws

Prerequisites:	550.620, 110.405
Text:	P. Billingsley, Probability and Measure, 3rd ed., Wiley, 1995 and K. L. Chung, A Course in Probability Theory, 3rd ed., Academic Press, 2002
Time:	MW 1:30 - 2:45 Section 01: F 3
Instructor:	Siu-tang Leung 202B Whitehead Hall 410-516-7582 timleung@jhu.edu

COURSE ANNOUNCEMENT

550.640 Machine Learning

Spring 2009

This course will focus on theoretical and practical aspects of statistical learning. We will review a collection of learning algorithms for classification and regression estimation, including linear methods, kernel methods, tree-based and boosting methods; we will also discuss unsupervised methods for linear and nonlinear data reduction and clustering. We will introduce fundamental concepts of the theory of model selection and validation: bias/variance dilemma, penalty methods, and some measures of complexity; the course will also include standard validation algorithms, like cross-validation and bootstrap.

Prerequisites: 550.430

Text: None

Time: MW 3:00 – 4:15

Instructor:
Laurent Younes
324C Clark Hall
410-516-5103
laurent.younes@jhu.edu

COURSE ANNOUNCEMENT

550.643 Graphical Models

Spring 2009

This course describes how models based on networks encoding the conditional dependency structure between random variables, also called graphical models, can be used to design multivariate probability distributions. A special focus will be made on important particular cases, like Markov Chains, Bayesian networks or Markov Random Fields. We will also discuss parametric estimation and inference problems, and issues arising when some of the variables cannot be observed.

Prerequisites: 550.420 or equivalent, 550.430 or equivalent

Text: TBA

Time: MW 4:30-5:45

Instructor:
Laurent Younes
324C Clark Hall
410-516-5103
laurent.younes@jhu.edu

COURSE ANNOUNCEMENT

550.662 Optimization Algorithms

Spring 2009

Design and analysis of algorithms for linear and nonlinear optimization. The revised simplex method, the primal-dual algorithm, algorithms for network problems, first- and second-order methods for nonlinear problems, quadratic programming techniques, and methods for constrained nonlinear problems.

Prerequisites:	550.661
Text:	M.S. Bazaraa, H.D. Sherali & C.M. Shetty, Nonlinear programming, 2nd ed. John Wiley and Sons, Inc
Time:	MWF 11 Section 01: F 1:30
Instructor:	Shih-Ping Han 201A Whitehead Hall 410-516-8515 han@ams.jhu.edu

COURSE ANNOUNCEMENT

550.672 Graph Theory

Spring 2009

See 550.472 for course description. Meets with 550.472

Prerequisites: Linear Algebra

Text: D.B. West, Introduction to Graph Theory, 2nd Edition

Time: MWF 9
Section 01: Th 10:30

Instructor:
Donniell Fishkind
Whitehead 304 B
410-516-7828
fishkind@ams.jhu.edu

COURSE ANNOUNCEMENT

550.681 Numerical Analysis

Spring 2009

Mathematical formulation and analysis of numerical algorithms. Brief review of topics in elementary numerical analysis such as floating-point arithmetic, Gaussian elimination for linear equations, interpolation and approximation. Core topics to be covered: numerical linear algebra including eigenvalue and linear least squares problems, iterative algorithms for nonlinear equations and least squares problems, and convergence theory of numerical methods. Other possible topics: sparse matrix computations, numerical solution of partial differential equations, finite element methods, and parallel algorithms.

Prerequisites:	Multivariable calculus, linear algebra, computing experience; coreq: 110.405
Text:	Kincaid and Cheney, Numerical Analysis, 3rd edition
Time:	MWF 12 Section 01: F 3
Instructor:	Shih-Ping Han 201A Whitehead Hall 410-516-8515 han@ams.jhu.edu

COURSE ANNOUNCEMENT

550.695 Advanced Parameterization in Science and Engineering

Spring 2009

This course will present an overview of topics in science-based parameterization, including dynamics, probability, and other applied mathematical methods. These concepts will be presented in a unified format, with some emphasis on scientific computing. Specific topics include: basic probability, statistical dynamics (moment hierarchies, Liouville/forward equations, path-integral methods), asymptotic closure (homogenization, Chapman-Enskog), closure techniques without any separation of scales (nonlinear Galerkin & weighted residuals, algebraic closures, PDF-based closures, down-scaling), uncertainty quantification (variance & other measures of uncertainty, Bayesian estimation, ensemble methods), hybrid methods.

Prerequisites:

Text:

Time: TBA

Instructor: Greg Eyink
202D Whitehead Hall
410-516-7201
eyink@ams.jhu.edu

COURSE ANNOUNCEMENT

550.730 Topics in Statistics: Roundtable in System Identification and Likelihood Methods

Spring 2009

The focus of this roundtable-format course will be stochastic modeling as relates to system identification and maximum likelihood. The principles and algorithms being covered in this course have tremendous importance in the world at large. For example, maximum likelihood is arguably the most popular method for parameter estimation in most real-world applications. *System identification* is the term used in many fields to refer to the process of mathematical model building from experimental data. The system identification process refers to several important aspects of model building, including selection of the model form (linear or nonlinear, static or dynamic, etc.), experimental design, parameter estimation, and model validation. This course will cover topics such as the maximum likelihood formulation and theory, the EM (expectation-maximization) algorithm and its variants, Fisher information, common model structures, online versus offline estimation, the role of feedback in identification (i.e., open-loop versus closed-loop estimation), standard and extended Kalman filtering, and uncertainty characterization (e.g., confidence regions).

Typically, each class session will cover an important paper from the literature or a selected JHU research project related to the course theme. In each session, the instructor or one or more students will have the responsibility to lead the discussion. Each student will be responsible for leading (or co-leading) several discussions over the duration of the semester. Discussion leaders will be responsible for preparing an informal presentation as a vehicle for sparking a dialogue about the subject at hand. (Aside from studying the technical material in the course, it is also intended that the roundtable provide a collegial setting for developing presentation skills.) Because course participants will be collectively exploring a relatively advanced topic at each class session, the discussion leader need not have a complete grasp of every aspect of the topic being studied; coming to class with pertinent questions and issues for discussion is encouraged as a vehicle for learning.

Prerequisites: Undergraduate-level matrix theory and ordinary differential equations; graduate-level course in probability and statistics (e.g., 550.430; in particular, students should have prior exposure to maximum likelihood and Bayes' rule). Prior experience in data analysis and algorithms will be helpful.

Day/Time: Tuesdays, 1:30–3:20 PM (adjustable as needed).

Credit hours: 3

Textbook: None. Journal and other readings will be provided throughout the course.

Instructor: James C. Spall, 443-778-4960, james.spall@jhuapl.edu

COURSE ANNOUNCEMENT

550.735 Statistical Pattern Recognition

Spring 2009

This course will focus on theoretical and practical issues in statistical pattern recognition. Real problems and data will be considered throughout. Topics to be covered may include: model selection & dimensionality reduction; modeling & inference on random graphs, and on time series thereof; modeling & inference for text document spaces; modeling & inference for shape classification; the conditionality principle in statistical pattern recognition; hierarchical methods; etc. Student interest will contribute to topic selection.

Prerequisites: Statistics; Probability

Text: Devroye, Gyorfi, Lugosi, "A Probabilistic Theory of Pattern Recognition."

Time: MW 4:30-6:30
Classes will be held only during the weeks of 1/26/09, 2/2/09, 2/9/09, 2/16/09, 4/6/09, 4/13/09, 4/20/09, 4/27/09

Instructor:
Carey E. Priebe
Whitehead 201 / Clark 301D
cep@jhu.edu

COURSE ANNOUNCEMENT

550.747 Topics in Financial Math

Spring 2009

This course is only open to students in the Financial Mathematics Master's program. Advanced topics chosen according to the interests of the instructor and the graduate students. The course will focus on recent research articles in the financial mathematics literature.

Prerequisites:

Text:

Time:	TF 8 Will also occasionally meet T 1:30 – 2:50 and F 4:30 – 5:45
Instructor:	David Audley 212A Whitehead Hall 410-516-7136 daudley@ams.jhu.edu