Course Announcement

550.111: Statistical Analysis I

Fall 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.

Time: MWF 12
Section 1: W 3
Section 2: W 4:30
Section 3: Th 10:30
Section 4: Th 12
Section 5: Th 1:30
Section 6: Th 3

Text: Anderson, Statistics for Business and Economics, 10th ed.

Instructor:
Nam Lee
212B Whitehead Hall
410-516-7596
nhlee@jhuedu

Course Announcement

550.112: Statistical Analysis II

Fall 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
Time:	MWF 1:30 Section 1: Th 10:30 Section 2: Th 12 Section 3: Th 1:30 Section 4: Th 3
Text:	McClave & Sincich, Statistics, 10th ed., Prentice Hall
Instructor:	Fred Torcaso 211B Whitehead Hall 410-516-4160 torcaso@ams.jhu.edu

Course Announcement

550.171: Discrete Mathematics

Fall 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
Time:	MWF 10 Section 1: Th 9 Section 2: Th 12 Section 3: Th 10:30
Text:	Edward Scheinerman, Mathematics: A Discrete Introduction, Brooks Cole
Instructor:	Beryl Castello 200 Whitehead Hall 410-516-7579 castello@ams.jhu.edu

Course Announcement

550.252: Mathematical Models for Decision Making: Stochastic Models

Fall 2009

This course is an introduction to management science and the quantitative approach to decision making. Our focus will be on the formulation and analysis of stochastic models, where some problem data may be uncertain. The covered topics may include Project Scheduling, Decision Analysis, Time Series Forecasting, Inventory Models with Stationary or Nonstationary Demand, Queuing Models, Discrete-Event Simulation, and Quality Management. We emphasize model development and case studies, using spreadsheets and other computer software. The applications we study occur in variety of applications.

Prerequisites:	One semester of Calculus. Some probability experience would be useful but is not required.
Time:	MWF 1:30 Section 1: Th 1:30
Text:	Applied Management Science: A Computer-Integrated Approach for Decision Making, J.A. Lawrence & B.A. Pasternack, 2nd ed.
Instructor:	Beryl Castello 200 Whitehead Hall 410-516-7579 castello@ams.jhu.edu

Course Announcement

550.291: Linear Algebra and Differential Equations

Fall 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.
Time:	MWF 9 Section 1: T 1:30 Section 2: T 3
Text:	Edwards and Penney, Differential Equations and Linear Algebra, 3rd ed. Prentice Hall
Instructor:	Fred Torcaso 211B Whitehead Hall 410-516-4160 torcaso@ams.jhu.edu

Course Announcement

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

Fall 2009

Students cannot recieve credit for both 550.310 and 550.311. Students cannot receive credit for 550.310 after having received credit for 550.420 or 550.430. 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

Time: MWF 11
Section 1: T 9
Section 2: T 3
Section 3: T 4:30

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

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

Course Announcement

550.311: Probability & Statistics for the Biological Sciences and Engineering

Fall 2009

Students cannot recieve credit for both 550.310 and 550.311. Students cannot receive credit for 550.311 after having received credit for 550.420 or 550.430. 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
Time:	MWF 10 Section 1: T 9 Section 2: T 3
Text:	Jay DeVore, Probability and Statistics for Engineering and the Sciences, 6th ed., Duxbury
Instructor:	Bruno Jedynak 208B Whitehead 410-516-7341 bruno.jedynak@jhu.edu

Course Announcement

550.361: Introduction to Optimization I

Fall 2009

This course introduces the formulation and solution of deterministic optimization problems, and focuses on linear programming. We consider a variety of applications, such as problems in engineering, systems analysis, manufacturing, transportation, and management. In addition to general linear programming we may touch on other optimization topics (sensitivity analysis, duality, network optimization, and integer programming) as time permits. Students will use Microsoft Excel to solve mathematical models.

Prerequisites: Calculus (e.g. 100.108-109), elements of linear algebra (550.291 is ample,) ability to use mathematical software

Time: MWF 12
Section 1: Th 1:30
Section 2: Th 3

Text: Introduction to Mathematical Programming, 4th ed., Winston & Venkataramanan, Brooks/Cole

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

Course Announcement

550.385: Scientific Computing: Linear Algebra

Fall 2009

A first course on computational linear algebra and applications. Topics include floating-point arithmetic, algorithms and convergence, Gaussian elimination for linear systems, matrix decompositions (LU, Cholesky, QR), iterative methods for systems (Jacobi, Gauss-Seidel), and approximating eigenvalues (power method, QR-algorithm). Theoretical topics such as vector spaces, inner products, norms, linear operators, matrix norms, eigenvalues, and canonical forms of matrices (Jordan, Schur) are reviewed 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)
Time:	MWF 9 Section 1: T 3
Text:	An Introduction to Numerical Analysis, 2nd ed., Atkinson, Wiley (Recommended)
Instructor:	Youngmi Hur 212C Whitehead Hall 410-516-7914 hur@jhu.edu

Course Announcement

550.391: Dynamical Systems

Fall 2009

A dynamical system is a mathematical model of a physical, chemical or biological system that changes over time. A simple example is a mass bouncing back-and-forth on a spring. This course will be of interest for students from many disciplines including engineering, biology, physics, and economics. We cover both the "classical" theory of dynamical systems (linear systems) and the "modern" (nonlinear). We will also study chaos - the phenomenon that completely deterministic (nonrandom) systems can behave in wildly unpredictable manners – and fractals: the study of shapes that are not well described using the usual geometric notions of line segments, circles, etc., such as the shape of clouds or trees.

Prerequisites: 110.202, linear algebra, computing experience

Time: MWF 10
Section 1: Th 12

Text: Stephen Strogatz, Nonlinear Dynamics and Chaos, Perseus Book Group 2001

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

Course Announcement

550.413: Applied Statistics and Data Analysis

Fall 2009

This course will introduce basic concepts and techniques in applied statistics, data analysis, regression modeling, and experimental design. The emphasis will be on statistical methods and models that are widely used across many disciplines. In addition to presenting an understanding of the statistical reasoning underlying the use of these techniques, the course will focus on application of the techniques to real problems. Techniques to be presented include regression (simple, multiple, polynomial), logistic regression, analysis of variance, and experimental designs (one-way, randomized block designs, multi-way factorials, incomplete blocks, and repeated measures). The course will consist of lectures and laboratory sessions, and include heavy use of statistical analysis software to address real problems. No prior knowledge of the software is necessary. Much of the coursework will include computer projects to analyze and draw conclusions from real datasets.

Prerequisites:	550.112 or equivalent
Time:	MW 4:30-5:45 Section 1: F 1:30
Text:	Applied Linear Statistical Models, 5th ed. Kutner, Nachtshem, Neter, Li, McGraw Hill/Irwin (also available as e-book)
Instructor:	Staff

Course Announcement

550.420: Introduction to Probability

Fall 2009

Probability theory originated in the consideration of gambling problems, but has become an important tool for scientists, engineers, medical practitioners, lawyers, and people working in business. A wide variety of phenomena are characterized by randomness and uncertainty, which is measured by probability. Probability models also play a fundamental role in the statistical analysis of data. The aim of the course is to provide an introduction to the elementary concepts of probability. The first part of the course will introduce the student to the basic ideas used to describe aspects of randomness, such as events, random variables, independence, and conditional probability. After students have developed familiarity with these concepts, the remainder of the course concentrates on the methods, calculation, and applications of probability, rather than more theoretical aspects. The topics treated are: discrete and continuous distributions, density functions, distribution theory, calculation and interpretation of moments, covariance and correlation, the classical central limit theorem and laws of large numbers, and standard probability inequalities.

Prerequisites: 110.108-109 (or otherwise one year of calculus), recommended corequisite 110.202 (multivariable calculus)

Time: MWF 1:30
Section 1: Th 10:30
Section 2: Th 12
Section 3: Th 1:30
Section 4: Th 3

Text: Sheldon Ross, A First Course in Probability, 8th edition, Prentice - Hall

Instructor:
John Wierman
211G Whitehead Hall
410-516-7211
wierman@jhu.edu

Course Announcement

550.427: Stochastic Processes in Finance

Fall 2009

The course introduces stochastic processes with substantial emphasis on the processes, concepts, and methods useful in mathematical finance. Relevant concepts from probability theory, particularly conditional probability and conditional expectation, will be briefly reviewed. Important concepts in stochastic processes will be introduced in the simpler setting of discrete-time processes, including random walks, Markov chains, and discrete-time martingales, then used to motivate more advanced material. Most of the course will concentrate on continuous-time stochastic processes, particularly martingales, Brownian motion, diffusions, and basic tools of stochastic calculus. Examples will focus on applications in finance, economics, business, and actuarial science.

Prerequisites:	550.420 Introduction to Probability
Time:	MWF 10 Section 1: T 4:30
Text:	Steven E. Shreve, Stochastic Calculus for Finance II: Continuous-Time Models, Springer-Verlag
Instructor:	Tim Leung 202B Whitehead Hall 410-516-7582 timleung@jhu.edu

Course Announcement

550.433: Monte Carlo Simulation

Fall 2009

The objective of the course is to survey various topics in the interface between computational probability and statistics, and reliability. The largest portion of the course devoted to Monte-Carlo simulation. A vast number of scientific and engineering fields are becoming increasingly reliant on large-scale computer simulations of stochastic systems. This is particularly true in reliability problems. Typically, users of these simulations would like to produce results that are as accurate and precise as possible while computing time and storage are limited. We will investigate several of the more common types of problems encountered in these modeling situations, and Monte Carlo methods that have been developed in response to these problems. General topics with subtopics to be treated will include the following: Generation of random variates from specified univariate distributions: acceptance-rejection, table lookup, algorithms based on trees, Generation of multivariate random variables: special families of multivariate distributions, Gaussian distributions and processes via transformations, Variance reduction techniques: control variates, common random numbers, importance sampling, Latin hypercube sampling, Markov chain methods: Monte Carlo Markov chains, perfect sampling, Bayesian calculations, Bayesian belief updating, Random number generation: design, testing

Prerequisites: 550.430 or equivalent, computing experience

Time: MWF 9

Text: TBD

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

Course Announcement

550.436: Data Mining

Fall 2009

Data mining is a relatively new term used in the academic and business world, often associated with the development and quantitative analysis of very large databases. Its definition covers a wide spectrum of analytic and information technology topics, such as machine learning, pattern recognition, artificial intelligence, statistical modeling, and efficient database development. This course will review these broad topics, and cover specific analytic and modeling techniques such as data cleaning techniques, principal components, regression, decision trees, neural networks, support vector machines, nearest neighbor, clustering, association rules, generalization error, and the holdout, cross-validation, and bootstrap methods. Although some of the mathematics underlying these techniques will be discussed, our focus will be on the application of the techniques to real data and the interpretation of results. Because use of the computer is extremely important when "mining" large amounts of data, we will make substantial use of data mining software tools to learn the techniques and analyze datasets.

Prerequisites: 550.310 or equivalent, Recommended prerequisite: 550.413

Time: MW 1:30-2:45
Section 1: Th 10:30

Text: TBD

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

Course Announcement

550.437: Statistical Learning with Applications

Fall 2009

Statistical modeling and inference, inductive learning and information theory together provide a cohesive framework for machine perception, which amounts to building a data-description machine converting physical measurements (images, molecular counts, etc.) to interpretations or descriptions. Recurring themes include quantifying uncertainty, estimating generalization error, model complexity, the bias/variance dilemma, small-sample learning and estimating interactions. Various problems in computational vision, speech and biology will be analyzed in this context, including visual tracking, object recognition, language modeling, molecular cancer diagnosis and learning gene networks.

Prerequisites: At least one course in probability and statistics at the 300-level

Time: MW 12-1:15

Text:

Instructor: Don Geman
302A Clark Hall
410-516-7678
geman@jhu.edu

Course Announcement

550.440: Stochastic Calculus

Fall 2009

The development of stochastic calculus started in the 1950s many years after rigorous probabilistic models for Brownian motion and physical diffusion - the models for which this calculus was intended. Today many naturally occurring processes in industry are modeled quite well by these probabilistic constructs, and, just as knowledge of calculus is crucial in optimization, stochastic calculus is the key tool for addressing interesting questions related to the problems these processes model. Some situations where stochastic calculus can be useful are in problems in which otherwise deterministic systems are subjected to small noise effects such as thermal noise, wind, and random vibrations. More recent applications of stochastic calculus are in financial asset pricing, buffered flow and stochastic cash management to name a few. This course is intended to be an introduction to stochastic calculus where no prior knowledge of Brownian motion and advanced mathematical ideas such as measure theory are assumed. This course should provide a treatment suitable for understanding the main concepts and give a working knowledge of the material without too much rigor, although some maturity will be assumed. Among the topics planned to be covered are: probability background; introduction to Brownian motion; conditional expectation; martingales; construction of the Riemann and Riemann-Stieltjes integrals; stochastic (Itô) integral and its interpretation; Itô's Lemma; basics of differential equations; stochastic differential equations; applications.

Prerequisites: 550.420; stochastic processes recommended, but not required

Time: MW 4:30-5:45

Text: J. Michael Steele, Stochastic Calculus, Springer-Verlag

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

Course Announcement

550.442: Investment Science

Fall 2009

Intended for upper-level undergraduate and graduate students, this course offers a rigorous treatment of the subject of investment as a scientific discipline. Mathematics is employed as the main tool to convey the principles of investment science and their use to make investment calculations for good decision-making. Topics covered in the course include the basic theory of interest and its application to fixed-income securities, cash flow analysis and capital budgeting, mean-variance portfolio theory, and the associated capital asset pricing model, utility function theory and risk analysis, derivative securities and basic option theory, portfolio evaluation. Although the mathematical background needed for the course is quite minimal, the student is expected to be comfortable with the use of mathematics as a method of deduction and problem solving. Specifically, interested students should have the prerequisite of one year of calculus and an introductory course in probability and statistics (such as 550.310 or its equivalent). Some familiarity with optimization is desirable but not necessary.

Prerequisites:	One year of Calculus, 550.310, 550.311, or equivalent
Time:	M 6-8:50 Section 1: Th 3
Text:	David G. Luenberger, Investment Science, Oxford University Press, 1997 and Fabozzi, Duration, Convexity, and Other Bond Risk Measures, Frank J. Fabozzi Associates, 1999; (recommended: Frank J. Fabozzi, Valuation of Fixed Income Securities and Derivatives.
Instructor:	James Tzitzouris jimt2@ams.jhu.edu

Course Announcement

550.444: Modeling and Analysis of Securities and Financial Markets I

Fall 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 cash instruments and their hybrids and derivatives. This includes equity (stocks) and fixed income (bonds) instruments as well as options, futures and other derivatives. In addition, the analytical complexities associated with market behavior and risks are addressed in the context of investment practice and hedging. A quantitative development of the term structure of interest rates and its fundamental relationship to assessing relative value is another core component of this course.

Prerequisites: 110.302 and 550.420

Time: MW 3-4:15
Section 1: F 3

Text: John C. Hull: Options, Futures, and Other Derivatives, Prentice-Hall, (6e) 2005

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

Course Announcement

550.447: Advanced Portfolio and Investment Theory

Fall 2009

This course focuses on modern quantitative portfolio theory, models, and analysis. Topics include intertemporal approaches to modeling and optimizing asset selection and asset allocation; benchmarks (indexes), performance assessment (including, Sharpe, Treynor and Jenson ratios) and performance attribution; immunization theorems; alpha-beta separation in management, performance measurement and attribution; Replicating Benchmark Index (RBI) strategies using cash securities/derivatives; Liability-Driven Investment (LDI); and the taxonomy and techniques of strategies for traditional management: Passive, Quasi-Passive (Indexing) Semi-Active (Immunization & Dedicated) Active (Scenario, Relative Value, Total Return and Optimization). In addition, risk management and hedging techniques are also addressed.

Prerequisites: 550.442 or 550.444

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

Text:

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

Course Announcement

550.457: Topics in Operations Research

Fall 2009

Supply Chains: Models and Analyses - This course will explore mathematical models, analytics and concepts arising in managing supply chains, with their issues of coordination and joint optimization beyond those for single-level firms.

Prerequisites:	550.361 and general mathematical maturity
Time:	MW 3-4:15
Text:	J. Shapiro, Modelling the Supply Chain, 2nd ed.
Instructor:	Alan Goldman 306G Whitehead Hall 410-516-7207 goldman@ams.jhu.edu

Course Announcement

550.461: Optimization in Finance

Fall 2009

A survey of many of the more important optimization methods and tools that are found to be useful in financial applications.

Prerequisites:	550.442 or 550.444
Time:	MW 3-4:15
Text:	
Instructor:	Staff

Course Announcement

550.471: Combinatorial Analysis

Fall 2009

We present a broad introduction to the problems and methods of combinatorial analysis, with emphasis on the enumeration and construction of arrangements (having desired properties) or discrete elements. Our topics include: subsets, distributions, partitions, inclusion/exclusion, generating functions, enumerations of symmetry classes (Polya theory), and combinatorial designs.

Prerequisites: Calculus, Linear Algebra

Time: MWF 12
Section 1: T 3

Text: Ken Bogart, Introductory Combinatorics, 3rd ed., Harcourt/Academic Press

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

Course Announcement

550.620: Probability Theory I

Fall 2009

The course objectives are to develop probabilistic reasoning and problem solving approaches, to provide a rigorous mathematical basis for probability theory, and to examine several important results in the theory of probability. Topics include axiomatic probability, independence, random variables and their distributions, expectation, integration, variance and moments, probability inequalities, and modes of convergence of random variables. The course will include introductory measure theory as needed. Students are expected to have previous study of both analysis and probability. This course is the first half of a yearlong sequence. The second semester's course, 550.621 Probability Theory II, will cover classical limit theorems, characteristic functions, and conditional expectation.

Prerequisites:	550.420 and 110.405, or equivalent courses
Time:	MW 1:30-2:45 Section 1: F 1:30
Text:	P. Billingsley, Probability and Measure, 3rd ed., Wiley, 1995 and K. L. Chung, A Course in Probability Theory, 3rd ed., Academic Press, 2001
Instructor:	James Fill 306F Whitehead Hall 410-516-7219 jimfill@jhu.edu

Course Announcement

550.630: Statistical Theory I

Fall 2009

The fundamentals of mathematical statistics will be covered. Topics include: distribution theory for statistics of normal samples, exponential statistical models, the sufficiency principle, least squares estimation, maximum likelihood estimation, uniform minimum variance unbiased estimation, hypothesis testing, the Neyman-Pearson lemma, likelihood ratio procedures, the general linear model, the Gauss-Markov theorem, simultaneous inference, decision theory, Bayes and minimax procedures, chi-square methods, goodness-of-fit tests, and nonparametric and robust methods.

Prerequisites:	550.420 or 550.620
Time:	MWF 11
Text:	Peter Bickel and Kjell Doksum, Mathematical Statistics: Basic Ideas and Selected Topics, Volume 1, 2nd ed. Updated Printing Holden-Day
Instructor:	Daniel Naiman 202C Whitehead Hall 410-516-7203 daniel.naiman@jhu.edu

Course Announcement

550.635: Topics in Bioinformatics

Fall 2009

A "readings" course organized around research articles in the recent computational biology literature. In this term, the topics covered will include: inferring phenotype from genotype based on gene microarray data; discovering gene regulatory patterns and networks from sequence and expression data; predicting active sites and detecting harmful mutations in proteins; and stochastic modeling of carcinogenesis. One major objective is to prepare students to comfortably read articles which involve extensive mathematical and statistical modeling as well as techniques from pattern recognition and machine learning. The papers will be presented by the students. However, all student expositions will be preceded by comprehensive “tutorials” by the instructor on the various “theoretical” issues in learning, modeling and inference required for understanding the papers, such as performance metrics, properly estimating generalization error, over-fitting, statistical genetics, graphical models (e.g., Bayesian networks and hidden Markov models), classification algorithms (e.g., SVMs) and stochastic simulation .

Prerequisites: A course in Statistics is required; some previous exposure to machine learning or pattern recognition is recommended. The course is suitable for prepared seniors through doctoral students in both the life sciences and engineering.

Time: MW 4:30-5:45

Text:

Instructor:
Donald Geman
302A Clark Hall
410-516-7678
geman@jhu.edu

Course Announcement

550.661: Foundations of Optimization

Fall 2009

This course is the first in a two-semester sequence on the theory, algorithms, and applications of optimization. The first semester focuses mainly on linear programming and the geometry of linear systems. Topics include the simplex method, revised simplex method, linear programming duality, theorems of the alternative, sensitivity analysis, and interior point methods for linear programming. In parallel with our theoretical development we will consider how to formulate mathematical programs for a variety of applications. We will also discuss some methods and applications of integer programming and dynamic programming.

Prerequisites:	110.202 or 550.291
Time:	MWF 10 Section 1: T 9
Text:	TBD
Instructor:	Shih-Ping Han 201A Whitehead Hall 410-516-8515 han@ams.jhu.edu

Course Announcement

550.671: Combinatorial Analysis

Fall 2009

We present a broad introduction to the problems and methods of combinatorial analysis, with emphasis on the enumeration and construction of arrangements (having desired properties) of discrete elements. Our topics include: subsets, distributions, partitions, inclusion/exclusion, generating functions, enumeration of symmetry cases (Polya theory), combinatorial designs, and posets.

Prerequisites:	Calculus, Linear Algebra
Time:	MWF 12 Section 1: T 4:30
Text:	Ken Bogart, Introductory Combinatorics, 3rd ed., Harcourt/Academic Press
Instructor:	Donniell Fishkind 304B Whitehead Hall 410-516-7828 fishkind@ams.jhu.edu

Course Announcement

550.692: Matrix Analysis and Linear Algebra

Fall 2009

The objective of the course will be to study interesting topics in matrix analysis and linear algebra that are not ordinarily included in a first course in linear algebra but are useful in the study of statistics, stochastic processes, optimization, mathematical economics, computer science, and numerical analysis. The course will include a review of linear algebra, and the following topics will be discussed: decomposition and factorization, positive definite matrices, norms and convergence, eigenvalue characterization and location, variational methods, positive and nonnegative matrices, generalized inverses.

Prerequisites:	550.291, 110.201, or 110.211-212; and 110.405
Time:	MWF 9 Section 1: T 10:30
Text:	R.A. Horn & C.R. Johnson, Matrix Analysis, Cambridge University Press, 1985
Instructor:	Donniell Fishkind 304B Whitehead Hall 410-516-7828 fishkind@ams.jhu.edu

Course Announcement

550.723: Markov Chains

Fall 2009

The course will discuss Markov chains; their uses in simulation; applications to discrete mathematics, computer science, physics, and statistics; rates of convergence to stationarity; and algorithms for perfect simulation.

Physicists are interested in models for ferromagnetism and for phase transitions (such as freezing). In such statistical mechanics problems, in image processing (the cleaning up of noisy or blurred images), and in computer science, much can be learned by studying certain probability distributions on sets having enormously large finite numbers of elements. The standard "Monte Carlo" approach to studying a distribution is to draw a (representative) random sample, but a direct approach to this is computationally infeasible for problems of such large size. To handle such problems, researchers construct and employ Markov chains which, in a certain precise sense, "settle down" to the distribution of interest "in the long run." But how long is long enough? This course will focus on techniques to estimate rates of convergence to stationarity (including eigenvalue bounding and comparison, group representation theory, coupling, strong stationary times and duality, evolving sets, and decomposition, together with study of how these techniques are interrelated and related also to absorption times for absorbing chains). Another focus will be algorithms, including coupling from the past (devised by Jim Propp and David Wilson), cycle popping (devised by David Wilson), and the Fill-Machida-Murdoch-Rosenthal (FMMR) algorithm, devised to use the same Markov chains to produce random samples distributed perfectly (i.e., exactly) according to the desired distribution. The Randomness Recycler (invented jointly by the instructor and Mark Huber), a perfect simulation technique with close connections to strong stationary duality and the FMMR algorithm, will also be treated. Markov chains with continuous state space (which arise frequently in Bayesian statistics, for example) will be discussed briefly.

Prerequisites:	550.620 or equivalent, or 550.420 with consent of instructor; 550.426 is recommended
Time:	TBA
Text:	None required; lecture notes and journal articles will be distributed
Instructor:	James Fill 306F Whitehead Hall 410-516-7219 jimfill@jhu.edu

Course Announcement

550.791: Neural Networks and Feedback Control Systems

Fall 2009

This roundtable courses is an introduction to two related areas - neural networks (NNs) and control systems based on the use of feedback. Artificial NNs are effective conceptual and computational vehicles for many important applications: feedback control is relevant to virtually all natural and human-made systems. NNs are applied in areas such as system modeling and control, function approximation, time-series filtering/prediction/smoothing, speech/image/signal processing and pattern recognition. Topics to be coered for NNs include parallel distributed processing, learning algorithms, and applications. Specific NNs discussed include perceptrons, feedforward networks with backpropagation, and recurrent networks. This course also provides an introduction to feedback control systems, including the role of feedback in regulating systems and in achieving stability in systems. We consider stochastic (noise) effects in feedback systems. We also consider the interface of NNs and control by discussing how NNs are used in building modern control systems in problems where standard methods are infeasible.

Prerequisites:	Matrix theory, differential equations, and a graduate course in probability and statistics
Time:	T 1:30-3:20
Text:	none
Instructor:	James Spall 303A Whitehead Hall 443-778-4960 james.spall@jhuapl.edu