

STATISTICS AND OPERATIONS RESEARCH (STOR)

STOR 52. First-Year Seminar: Decisions, Decisions, Decisions. 3 Credits.

In this course, we will investigate the structure of these decision problems, show how they can be solved (at least in principle), and solve some simple problems.

Gen Ed: QI.

Grading status: Letter grade.

STOR 53. FYS: Networks: Degrees of Separation and Other Phenomena Relating to Connected Systems. 3 Credits.

Networks, mathematical structures that are composed of nodes and a set of lines joining the nodes, are used to model a wide variety of familiar systems.

Gen Ed: QI.

Grading status: Letter grade.

STOR 54. First-Year Seminar: Adventures in Statistics. 3 Credits.

This seminar aims to show that contrary to common belief, statistics can be exciting and fun. The seminar will consist of three modules: statistics in our lives, randomness, and principles of statistical reasoning.

Gen Ed: QI.

Grading status: Letter grade.

STOR 55. First-Year Seminar: Risk and Uncertainty in the Real World. 3 Credits.

The aim of this class is to study the role of uncertainty in our daily lives, to explore the cognitive biases that impair us, and to understand how one uses quantitative models to make decisions under uncertainty in a wide array of fields including medicine, law, finance, and the sciences.

Gen Ed: QI.

Grading status: Letter grade.

STOR 56. First-Year Seminar: The Art and Science of Decision Making in War and Peace. 3 Credits.

This seminar will use recently assembled historical material to tell the exciting story of the origins and development of operations research during and after World War II.

Gen Ed: QI.

Grading status: Letter grade.

STOR 60. First-Year Seminar: Statistical Decision-Making Concepts. 3 Credits.

We will study some basic statistical decision-making procedures and the errors and losses they lead to. We will analyze the effects of randomness on decision making using computer experimentation and physical experiments with real random mechanisms like dice, cards, and so on.

Gen Ed: QI.

Grading status: Letter grade.

STOR 61. First-Year Seminar: Statistics for Environmental Change. 3 Credits.

Studies the Environmental Protection Agency's Criteria Document, mandated by the Clean Air Act; this document reviews current scientific evidence concerning airborne particulate matter. Students learn some of the statistical methods used to assess the connections between air pollution and mortality, and prepare reports on studies covered in the Criteria Document.

Gen Ed: QI.

Grading status: Letter grade.

STOR 62. First-Year Seminar: Probability and Paradoxes. 3 Credits.

The theory of probability, which can be used to model the uncertainty and chance that exist in the real world, often leads to surprising conclusions and seeming paradoxes. We survey and study these, along with other paradoxes and puzzling situations arising in logic, mathematics, and human behavior.

Gen Ed: QI.

Grading status: Letter grade.

STOR 63. FYS: Statistics, Biostatistics, and Bioinformatics: An Introduction to the Ongoing Evolution. 3 Credits.

This course is designed to emphasize the motivation, philosophy, and cultivation of statistical reasoning in the interdisciplinary areas of statistical science and bioinformatics.

Gen Ed: QI.

Grading status: Letter grade.

STOR 64. First-Year Seminar: A Random Walk down Wall Street. 3 Credits.

Introduces basic concepts in finance and economics, useful tools for collecting and summarizing financial data, and simple probability models for quantification of market uncertainty.

Gen Ed: QI.

Grading status: Letter grade.

STOR 66. First-Year Seminar: Visualizing Data. 3 Credits.

This seminar looks at a variety of ways in which modern computational tools allow easy and informative viewing of data. Students will also study the kinds of choices that have to be made in data presentation and viewing.

Gen Ed: QI.

Grading status: Letter grade.

STOR 72. First-Year Seminar: Unlocking the Genetic Code. 3 Credits.

Introduces students to the world of genetics and DNA and to the use of computers to organize and understand the complex systems associated with the structure and dynamics of DNA and heredity.

Gen Ed: QI.

Grading status: Letter grade.

STOR 89. First-Year Seminar: Special Topics. 3 Credits.

Special Topics Course. Contents will vary each semester.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 6 total credits. 2 total completions.

Grading status: Letter grade.

STOR 112. Decision Models for Business. 3 Credits.

An introduction to the basic quantitative models of business with linear and nonlinear functions of single and multiple variables. Linear and nonlinear optimization models and decision models under uncertainty will be covered.

Requisites: Prerequisite, MATH 110.

Gen Ed: QR.

Grading status: Letter grade.

STOR 113. Decision Models for Business and Economics. 3 Credits.

An introduction to multivariable quantitative models in economics. Mathematical techniques for formulating and solving optimization and equilibrium problems will be developed, including elementary models under uncertainty.

Requisites: Prerequisite, MATH 110.

Gen Ed: QR.

Grading status: Letter grade.

STOR 151. Introduction to Data Analysis. 3 Credits.

Elementary introduction to statistical reasoning, including sampling, elementary probability, statistical inference, and data analysis. STOR 151 may not be taken for credit by students who have credit for ECON 400 or PSYC 210.

Requisites: Prerequisite, MATH 110.

Gen Ed: QR.

Grading status: Letter grade.

STOR 155. Introduction to Data Models and Inference. 3 Credits.

Data analysis; correlation and regression; sampling and experimental design; basic probability (random variables, expected values, normal and binomial distributions); hypothesis testing and confidence intervals for means, proportions, and regression parameters; use of spreadsheet software.

Requisites: Prerequisite, MATH 110.

Gen Ed: QR.

Grading status: Letter grade.

STOR 215. Foundations of Decision Sciences. 3 Credits.

Introduction to basic concepts and techniques of discrete mathematics with applications to business and social and physical sciences. Topics include logic, sets, functions, combinatorics, discrete probability, graphs, and networks.

Requisites: Prerequisite, MATH 110.

Gen Ed: QR.

Grading status: Letter grade.

STOR 305. Decision Making Using Spreadsheet Models. 3 Credits.

The use of mathematics to describe and analyze large-scale decision problems. Situations involving the allocation of resources, making decisions in a competitive environment, and dealing with uncertainty are modeled and solved using suitable software packages.

Requisites: Prerequisite, MATH 152 or STOR 155.

Gen Ed: QI.

Grading status: Letter grade.

STOR 320. Introduction to Data Science. 3 Credits.

Development of basic skill set for data analysis from obtaining data to data carpentry, exploration, modeling, and communication. Topics covered include regression, clustering, classification, algorithmic thinking, and non-standard data objects (networks and text data).

Requisites: Prerequisite, STOR 155.

Gen Ed: QI.

Grading status: Letter grade.

STOR 358. Sample Survey Methodology. 4 Credits.

Fundamental principles and methods of sampling populations, with emphasis on simple, random, stratified, and cluster sampling. Sample weights, nonsampling error, and analysis of data from complex designs are covered. Practical experience through participation in the design, execution, and analysis of a sampling project.

Requisites: Prerequisite, BIOS 550; permission of the instructor for students lacking the prerequisite.

Gen Ed: EE- Field Work.

Grading status: Letter grade

Same as: BIOS 664.

STOR 390. Special Topics in Statistics and Operations Research. 3 Credits.

Examines selected topics from statistics and operations research. Course description is available from the department office.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 4 total completions.

Grading status: Letter grade.

STOR 415. Introduction to Optimization. 3 Credits.

Linear, integer, nonlinear, and dynamic programming, classical optimization problems, network theory.

Requisites: Prerequisite, MATH 547.

Grading status: Letter grade.

STOR 435. Introduction to Probability. 3 Credits.

Introduction to mathematical theory of probability covering random variables; moments; binomial, Poisson, normal and related distributions; generating functions; sums and sequences of random variables; and statistical applications.

Requisites: Prerequisite, MATH 233.

Gen Ed: QI.

Grading status: Letter grade

Same as: MATH 535.

STOR 445. Stochastic Modeling. 3 Credits.

Introduction to Markov chains, Poisson process, continuous-time Markov chains, renewal theory. Applications to queueing systems, inventory, and reliability, with emphasis on systems modeling, design, and control.

Requisites: Prerequisite, BIOS 660 or STOR 435.

Grading status: Letter grade.

STOR 455. Methods of Data Analysis. 3 Credits.

Review of basic inference; two-sample comparisons; correlation; introduction to matrices; simple and multiple regression (including significance tests, diagnostics, variable selection); analysis of variance; use of statistical software.

Requisites: Prerequisite, STOR 155.

Grading status: Letter grade.

STOR 465. Simulation for Analytics. 3 Credits.

Introduces concepts of random number generation, random variate generation, and discrete event simulation of stochastic systems. Students perform simulation experiments using standard simulation software.

Requisites: Prerequisites, STOR 155 and 435.

Grading status: Letter grade.

STOR 471. Long-Term Actuarial Models. 3 Credits.

Probability models for long-term insurance and pension systems that involve future contingent payments and failure-time random variables. Introduction to survival distributions and measures of interest and annuities-certain.

Requisites: Prerequisite, STOR 435.

Gen Ed: QI.

Grading status: Letter grade.

STOR 472. Short Term Actuarial Models. 3 Credits.

Short term probability models for potential losses and their applications to both traditional insurance systems and conventional business decisions. Introduction to stochastic process models of solvency requirements.

Requisites: Prerequisite, STOR 435.

Grading status: Letter grade.

STOR 493. Internship in Statistics and Operations Research. 3 Credits.

Requires permission of the department. Statistics and analytics majors only. An opportunity to obtain credit for an internship related to statistics, operations research, or actuarial science. Pass/Fail only. Does not count toward the statistics and analytics major or minor.

Gen Ed: EE- Academic Internship.

Repeat rules: May be repeated for credit. 6 total credits. 2 total completions.

Grading status: Pass/Fail.

STOR 496. Undergraduate Reading and Research in Statistics and Operations Research. 1-3 Credits.

Permission of the director of undergraduate studies. This course is intended mainly for students working on honors projects. May be repeated for credit.

Gen Ed: EE- Mentored Research.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 6 total credits. 6 total completions.

Grading status: Letter grade.

STOR 555. Mathematical Statistics. 3 Credits.

Functions of random samples and their probability distributions, introductory theory of point and interval estimation and hypothesis testing, elementary decision theory.

Requisites: Prerequisite, STOR 435.

Grading status: Letter grade.

STOR 556. Advanced Methods of Data Analysis. 3 Credits.

Topics selected from: design of experiments, sample surveys, nonparametrics, time-series, multivariate analysis, contingency tables, logistic regression, and simulation. Use of statistical software packages.

Requisites: Prerequisites, STOR 435 and 455.

Grading status: Letter grade.

STOR 565. Machine Learning. 3 Credits.

Introduction to theory and methods of machine learning including classification; Bayes risk/rule, linear discriminant analysis, logistic regression, nearest neighbors, and support vector machines; clustering algorithms; overfitting, estimation error, cross validation.

Requisites: Prerequisites, STOR 215 or MATH 381, and STOR 435.

Grading status: Letter grade.

STOR 612. Models in Operations Research. 3 Credits.

Required preparation, calculus of several variables, linear or matrix algebra. Formulation, solution techniques, and sensitivity analysis for optimization problems which can be modeled as linear, integer, network flow, and dynamic programs. Use of software packages to solve linear, integer, and network problems.

Grading status: Letter grade.

STOR 614. Linear Programming. 3 Credits.

Required preparation, calculus of several variables, linear or matrix algebra. The theory of linear programming, computational methods for solving linear programs, and an introduction to nonlinear and integer programming. Basic optimality conditions, convexity, duality, sensitivity analysis, cutting planes, and Karush-Kuhn-Tucker conditions.

Grading status: Letter grade.

STOR 634. Probability I. 3 Credits.

Required preparation, advanced calculus. Lebesgue and abstract measure and integration, convergence theorems, differentiation. Radon-Nikodym theorem, product measures. Fubini theorems. L_p spaces.

Grading status: Letter grade.

STOR 635. Probability II. 3 Credits.

Foundations of probability. Basic classical theorems. Modes of probabilistic convergence. Central limit problem. Generating functions, characteristic functions. Conditional probability and expectation.

Requisites: Prerequisite, STOR 634; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade

Same as: MATH 635.

STOR 641. Stochastic Models in Operations Research I. 3 Credits.

Review of probability, conditional probability, expectations, transforms, generating functions, special distributions, and functions of random variables. Introduction to stochastic processes. Discrete-time Markov chains. Transient and limiting behavior. First passage times.

Requisites: Prerequisite, STOR 435.

Grading status: Letter grade.

STOR 642. Stochastic Models in Operations Research II. 3 Credits.

Exponential distribution and Poisson process. Birth-death processes, continuous-time Markov chains. Transient and limiting behavior. Applications to elementary queueing theory. Renewal processes and regenerative processes.

Requisites: Prerequisite, STOR 641.

Grading status: Letter grade.

STOR 654. Statistical Theory I. 3 Credits.

Required preparation, two semesters of advanced calculus. Probability spaces. Random variables, distributions, expectation. Conditioning. Generating functions. Limit theorems: LLN, CLT, Slutsky, delta-method, big-O in probability. Inequalities. Distribution theory: normal, chi-squared, beta, gamma, Cauchy, other multivariate distributions. Distribution theory for linear models.

Grading status: Letter grade.

STOR 655. Statistical Theory II. 3 Credits.

Point estimation. Hypothesis testing and confidence sets. Contingency tables, nonparametric goodness-of-fit. Linear model optimality theory: BLUE, MVU, MLE. Multivariate tests. Introduction to decision theory and Bayesian inference.

Requisites: Prerequisite, STOR 654.

Grading status: Letter grade.

STOR 664. Applied Statistics I. 3 Credits.

Permission of the instructor. Basics of linear models: matrix formulation, least squares, tests. Computing environments: SAS, MATLAB, S+. Visualization: histograms, scatterplots, smoothing, QQ plots. Transformations: log, Box-Cox, etc. Diagnostics and model selection.

Grading status: Letter grade.

STOR 665. Applied Statistics II. 3 Credits.

ANOVA (including nested and crossed models, multiple comparisons). GLM basics: exponential families, link functions, likelihood, quasi-likelihood, conditional likelihood. Numerical analysis: numerical linear algebra, optimization; GLM diagnostics. Simulation: transformation, rejection, Gibbs sampler.

Requisites: Prerequisite, STOR 664; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade.

STOR 672. Simulation Modeling and Analysis. 3 Credits.

Introduces students to modeling, programming, and statistical analysis applicable to computer simulations. Emphasizes statistical analysis of simulation output for decision-making. Focuses on discrete-event simulations and discusses other simulation methodologies such as Monte Carlo and agent-based simulations. Students model, program, and run simulations using specialized software. Familiarity with computer programming recommended.

Requisites: Prerequisites, STOR 555 and 641.

Grading status: Letter grade

Same as: COMP 672.

STOR 691H. Honors in Statistics and Analytics. 3 Credits.

Permission of the department. Majors only. Individual reading, study, or project supervised by a faculty member.

Gen Ed: EE- Mentored Research.

Grading status: Letter grade.

STOR 692H. Honors in Statistics and Analytics. 3 Credits.

Permission of the department. Majors only. Individual reading, study, or project supervised by a faculty member.

Gen Ed: EE- Mentored Research.

Grading status: Letter grade.

STOR 701. Statistics and Operations Research Colloquium. 1 Credit.

This seminar course is intended to give Ph.D. students exposure to cutting edge research topics in statistics and operations research and assist them in their choice of a dissertation topic. The course also provides a forum for students to meet and learn from major researchers in the field.

Repeat rules: May be repeated for credit. 10 total credits. 10 total completions.

Grading status: Letter grade.

STOR 705. Operations Research Practice. 3 Credits.

Gives students an opportunity to work on an actual operations research project from start to finish under the supervision of a faculty member. Intended exclusively for operations research students.

Requisites: Prerequisites, STOR 614, 641, and 672; Permission of the instructor for students lacking the prerequisites.

Grading status: Letter grade.

STOR 712. Mathematical Programming I. 3 Credits.

Advanced topics from mathematical programming such as geometry of optimization, parametric analysis, finiteness and convergence proofs, and techniques for large-scale and specially structured problems.

Requisites: Prerequisites, MATH 661 and STOR 614; permission of the instructor for students lacking the prerequisites.

Grading status: Letter grade.

STOR 713. Mathematical Programming II. 3 Credits.

Advanced theory for nonlinear optimization. Algorithms for unconstrained and constrained problems.

Requisites: Prerequisite, STOR 712; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade.

STOR 722. Integer Programming. 3 Credits.

Techniques for formulating and solving discrete valued and combinatorial optimization problems. Topics include enumerative and cutting plane methods, Lagrangian relaxation, Benders' decomposition, knapsack problems, and matching and covering problems.

Requisites: Prerequisite, STOR 614; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade.

STOR 724. Networks. 3 Credits.

Network flow problems and solution algorithms; maximum flow, shortest route, assignment, and minimum cost flow problems; Hungarian and out-of-kilter algorithms; combinatorial and scheduling applications.

Requisites: Prerequisite, STOR 614; permission of the instructor for students lacking the prerequisites.

Grading status: Letter grade.

STOR 734. Stochastic Processes. 3 Credits.

Discrete and continuous parameter Markov chains, Brownian motion, stationary processes.

Requisites: Prerequisite, STOR 435.

Grading status: Letter grade.

STOR 743. Stochastic Models in Operations Research III. 3 Credits.

Intermediate queueing theory, queueing networks. Reliability. Diffusion processes and applications. Markov decision processes (stochastic dynamic programming): finite horizon, infinite horizon, discounted and average-cost criteria.

Requisites: Prerequisite, STOR 642.

Grading status: Letter grade.

STOR 744. Queueing Networks. 3 Credits.

Jackson networks; open and closed. Reversibility and quasi-reversibility. Product form networks. Nonproduct form networks. Approximations. Applications to computer performance evaluations and telecommunication networks.

Requisites: Prerequisite, STOR 642; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade.

STOR 754. Time Series and Multivariate Analysis. 3 Credits.

Introduction to time series: exploratory analysis, time-domain analysis and ARMA models, Fourier analysis, state space analysis. Introduction to multivariate analysis: principal components, canonical correlation, classification and clustering, dimension reduction.

Requisites: Prerequisites, STOR 435 and 555.

Grading status: Letter grade.

STOR 755. Estimation, Hypothesis Testing, and Statistical Decision. 3 Credits.

Bayes procedures for estimation and testing. Minimax procedures. Unbiased estimators. Unbiased tests and similar tests. Invariant procedures. Sufficient statistics. Confidence sets. Large sample theory. Statistical decision theory.

Requisites: Prerequisites, STOR 635 and 655.

Grading status: Letter grade.

STOR 756. Design and Robustness. 3 Credits.

Introduction to experimental design, including classical designs, industrial designs, optimality, and sequential designs. Introduction to robust statistical methods; bootstrap, cross-validation, and resampling.

Requisites: Prerequisite, STOR 555.

Grading status: Letter grade.

STOR 757. Bayesian Statistics and Generalized Linear Models. 3 Credits.

Bayes factors, empirical Bayes theory, applications of generalized linear models.

Requisites: Prerequisite, STOR 555.

Grading status: Letter grade.

STOR 763. Statistical Quality Improvement. 3 Credits.

Methods for quality improvement through process control, graphical methods, designed experimentation. Shewhart charts, cusum schemes, methods for autocorrelated multivariate process data, process capability analysis, factorial and response surface designs, attribute sampling.

Requisites: Prerequisites, STOR 655 and 664.

Grading status: Letter grade.

STOR 765. Statistical Consulting. 1.5 Credit.

Application of statistics to real problems presented by researchers from the University and local companies and institutes. (Taught over two semesters for a total of 3 credits.)

Repeat rules: May be repeated for credit. 3 total credits. 2 total completions.

Grading status: Letter grade.

STOR 767. Advanced Statistical Machine Learning. 3 Credits.

This is a graduate course on statistical machine learning.

Requisites: Prerequisites, STOR 654,655, 664, 665 and permission of the instructor.

Grading status: Letter grade.

STOR 772. Introduction to Inventory Theory. 3 Credits.

Permission of the instructor. Introduction to the techniques of constructing and analyzing mathematical models of inventory systems.

Grading status: Letter grade.

STOR 790. Operations Research and Systems Analysis Student Seminar. 1 Credit.

Survey of literature in operations research and systems analysis.

Grading status: Letter grade.

STOR 822. Topics in Discrete Optimization. 3 Credits.

Topics may include polynomial algorithms, computational complexity, matching and matroid problems, and the traveling salesman problem.

Requisites: Prerequisite, STOR 712; Permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade

Same as: COMP 822.

STOR 824. Computational Methods in Mathematical Programming. 3 Credits.

Advanced topics such as interior point methods, parallel algorithms, branch and cut methods, and subgradient optimization.

Requisites: Prerequisite, STOR 712; Permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade.

STOR 831. Advanced Probability. 3 Credits.

Advanced theoretic course, covering topics selected from weak convergence theory, central limit theorems, laws of large numbers, stable laws, infinitely divisible laws, random walks, martingales.

Requisites: Prerequisites, STOR 634 and 635.

Repeat rules: May be repeated for credit. 9 total credits. 3 total completions.

Grading status: Letter grade.

STOR 832. Stochastic Processes. 3 Credits.

Advanced theoretic course including topics selected from foundations of stochastic processes, renewal processes, Markov processes, martingales, point processes.

Requisites: Prerequisites, STOR 634 and 635.

Grading status: Letter grade.

STOR 833. Time Series Analysis. 3 Credits.

Analysis of time series data by means of particular models such as autoregressive and moving average schemes. Spectral theory for stationary processes and associated methods for inference. Stationarity testing.

Requisites: Prerequisites, STOR 634 and 635.

Grading status: Letter grade.

STOR 834. Extreme Value Theory. 3 Credits.

This course covers both mathematical theory and statistical methodology concerned with extreme values in sequences of random variables. IID theory: the three types of extreme value distributions, statistical methods by block maxima and threshold exceedances. Extensions to dependent stochastic sequences: the extremal index and related concepts. Multivariate and spatial extremes, max-stable process. Applications in: engineering and strength of materials; finance and insurance; environment and climate.

Requisites: Prerequisites, STOR 635 and 654.

Grading status: Letter grade.

STOR 835. Point Processes. 3 Credits.

Random measures and point processes on general spaces, Poisson and related processes, regularity, compounding. Point processes on the real line stationarity, Palm distributions, Palm-Khintchine formulae. Convergence and related topics.

Requisites: Prerequisite, STOR 635.

Grading status: Letter grade.

STOR 836. Stochastic Analysis. 3 Credits.

Brownian motion, semimartingale theory, stochastic integrals, stochastic differential equations, diffusions, Girsanov's theorem, connections with elliptic PDE, Feynman-Kac formula. Applications: mathematical finance, stochastic networks, biological modeling.

Requisites: Prerequisites, STOR 634 and 635.

Grading status: Letter grade.

STOR 842. Control of Stochastic Systems in Operations Research. 3 Credits.

Review of Markov decision processes. Monotone control policies. Algorithms. Examples: control of admission, service, routing and scheduling in queues and networks of queues. Applications: manufacturing systems, computer/communication systems.

Requisites: Prerequisites, STOR 641 and 642.

Grading status: Letter grade.

STOR 851. Sequential Analysis. 3 Credits.

Hypothesis testing and estimation when sample size depends on the observations. Sequential probability ratio tests. Sequential design of experiments. Optimal stopping. Stochastic approximation.

Requisites: Prerequisites, STOR 635 and 655.

Grading status: Letter grade.

STOR 852. Nonparametric Inference: Rank-Based Methods. 3 Credits.

Estimation and testing when the functional form of the population distribution is unknown. Rank, sign, and permutation tests. Optimum nonparametric tests and estimators including simple multivariate problems.

Requisites: Prerequisites, STOR 635 and 655.

Grading status: Letter grade.

STOR 853. Nonparametric Inference: Smoothing Methods. 3 Credits.

Density and regression estimation when no parametric model is assumed. Kernel, spline, and orthogonal series methods. Emphasis on analysis of the smoothing problem and data based smoothing parameter selectors.

Requisites: Prerequisites, STOR 635 and 655.

Grading status: Letter grade.

STOR 854. Statistical Large Sample Theory. 3 Credits.

Asymptotically efficient estimators; maximum likelihood estimators. Asymptotically optimal tests; likelihood ratio tests.

Requisites: Prerequisites, STOR 635 and 655.

Grading status: Letter grade.

STOR 855. Subsampling Techniques. 3 Credits.

Basic subsampling concepts: replicates, empirical c.d.f., U-statistics.
 Subsampling for i.i.d. data: jackknife, typical-values, bootstrap.
 Subsampling for dependent or nonidentically distributed data: blockwise and other methods.

Requisites: Prerequisite, STOR 655.

Grading status: Letter grade.

STOR 856. Multivariate Analysis. 3 Credits.

Required preparation, matrix theory, multivariate normal distributions. Related distributions. Tests and confidence intervals. Multivariate analysis of variance, covariance and regression. Association between subsets of a multivariate normal set. Theory of discriminant, canonical, and factor analysis.

Requisites: Prerequisite, STOR 655.

Grading status: Letter grade.

STOR 857. Nonparametric Multivariate Analysis. 3 Credits.

Nonparametric MANOVA. Large sample properties of the tests and estimates. Robust procedures in general linear models, including the growth curves. Nonparametric classification problems.

Requisites: Prerequisite, STOR 852.

Grading status: Letter grade.

STOR 881. Object Oriented Data Analysis. 1-3 Credits.

Object Oriented Data Analysis (OODA) is the statistical analysis of populations of complex objects. Examples include data sets where the data points could be curves, images, shapes, movies, or tree structured objects.

Grading status: Letter grade.

STOR 890. Special Problems. 1-3 Credits.

Permission of the instructor.

Repeat rules: May be repeated for credit.

Grading status: Letter grade.

STOR 891. Special Problems. 1-3 Credits.

Permission of the instructor.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics.

Grading status: Letter grade.

STOR 892. Special Topics in Operations Research and Systems Analysis. 1-3 Credits.

Permission of the instructor.

Repeat rules: May be repeated for credit.

Grading status: Letter grade.

STOR 893. Special Topics. 1-3 Credits.

Advance topics in current research in statistics and operations research.

Repeat rules: May be repeated for credit.

Grading status: Letter grade.

STOR 894. Special Topics at SAMSI. 3 Credits.

Advanced topics in current research in statistics and operations research. This course is held at SAMSI.

Repeat rules: May be repeated for credit. 6 total credits. 2 total completions.

Grading status: Letter grade.

STOR 910. Directed Reading in Operations Research and Systems Analysis. 1-21 Credits.

Permission of the instructor.

Grading status: Letter grade.

STOR 930. Advanced Research. 1-3 Credits.

Permission of the instructor.

Grading status: Letter grade.

STOR 940. Seminar in Theoretical Statistics. 1-3 Credits.

Prerequisite, STOR 655.

Repeat rules: May be repeated for credit.

Grading status: Letter grade.

STOR 950. Advanced Research. 0.5-21 Credits.

Permission of the instructor.

Grading status: Letter grade.

STOR 960. Seminar in Theoretical Statistics. 0.5-21 Credits.

Prerequisite, STOR 655.

Grading status: Letter grade.

STOR 970. Practicum. 1-3 Credits.

Students work with other organizations (Industrial/Governmental) to gain practical experience in Statistics and Operations Research.

Repeat rules: May be repeated for credit.

Grading status: Letter grade.

STOR 992. Master's (Non-Thesis). 3 Credits.

Permission of instructor.

Repeat rules: May be repeated for credit.

STOR 994. Doctoral Research and Dissertation. 3 Credits.

Permission of instructor.

Repeat rules: May be repeated for credit.