INDIANA UNIVERSITY

University Graduate School
2009-2010
Academic Bulletin

Statistics

College of Arts and Sciences
Bloomington

Chairperson
Professor Stanley Wasserman*

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Departmental URL
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Graduate Faculty

(An asterisk [*] denotes membership in the University Graduate School faculty with the endorsement to direct doctoral dissertations.)

Rudy Professors
Karen Kafadar*, Stanley Wasserman*

Chancellor's Professor
J. Scott Long*

Professors
Steen Andersson*, Lanh Tran*, Michael Trosset*

Assistant Professors
Chunfeng Huang*, Guilherme Rocha*

Adjunct Professors
Franklin Acito* (Business), Richard Bradley* (Mathematics), Jerome Busemeyer* (Psychological and Brain Sciences), Victor Goodman* (Emeritus, Mathematics), Andrew Hanson* (Computer Science), John Kruschke* (Psychological and Brain Sciences), Russell Lyons* (Mathematics), Robert Nosofsky* (Psychological and Brain Sciences), Joanne Peng* (Education), Scott Robeson* (Geography), Richard Shiffrin* (Psychological and Brain Sciences), James Townsend* (Psychological and Brain Sciences), Pravin Trivedi* (Economics), Alessandro Vespignani* (Informatics)

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Elizabeth Housworth* (Mathematics), Christopher Raphael* (Informatics)

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Adjunct Assistant Professors
Juan Carlos Escanciano* (Economics), David Jacho-Chavez (Economics), Yoon-Jin Lee (Economics)

Director of Graduate Studies
Stanley Wasserman*

Degree Offered

Master of Science in Applied Statistics

Special Departmental Requirements

(See also general University Graduate School requirements.)

Master of Science in Applied Statistics

Background
The M.S. in Applied Statistics is intended for the student pursuing a Ph.D. or an M.S. in another field who wishes to enhance his or her statistical knowledge and credentials by obtaining a graduate degree in Statistics, in addition to a graduate degree in his or her primary field of study. Admission to this program requires that the student has been admitted for graduate studies in another field at IU and is in good academic standing.

Course Requirements
A total of 31 credit hours, or 10 courses. Required courses are: STAT S520, S631, S632, and S690. Two courses should be chosen from the following electives: MATH M463, STAT S620, STAT S625, S626, S637, S640, and S670. The remaining 12 credit hours should be taken in an area relevant to the field of Statistics, and must be approved by the Director of Graduate Studies.

Research Paper
Recommended, but not required.

Ph.D. Minor in Statistical Science

Doctoral students obtaining a Ph.D. in another discipline are welcome to choose Statistics as an outside minor. Five graduate courses in statistics are required, at least three of which must be at the 600-level or above taken from the Department of Statistics. The specific minor courses must be approved by the Director of Graduate Studies of the Department of Statistics.

Degrees Forthcoming

Master of Science in Statistical Science
Doctor of Philosophy in Statistical Science

Courses

S520 Introduction to Statistics (3 cr.) P: MATH M212, M301, M303, or the equivalent. Basic concepts of data analysis and statistical inference, applied to 1-sample and 2-sample location problems, the analysis of variance, and linear regression. Probability models and statistical methods applied to practical situations and actual data sets from various disciplines. Elementary statistical theory, including the plug-in principle, maximum likelihood, and the method of least squares.

S620 Introduction to Statistical Theory (3 cr.) P: STAT S320 and MATH M463 (or equivalent courses). Fundamental concepts and principles of data reduction and statistical inference, including the method of maximum likelihood, the method of least squares, and Bayesian inference. Theoretical justification of statistical procedures introduced in S320.

S625 Nonparametric Theory and Data Analysis (3 cr.) P: Two statistics courses at the graduate level, or consent of instructor. Survey of methods for statistical inference that do not rely on parametric probability models. Statistical functionals, bootstrapping, empirical likelihood. Nonparametric density and curve estimation. Rank and permutation tests.

S626 Bayesian Theory and Data Analysis (3 cr.) P: Two statistics courses at the graduate level, or consent of instructor. Introduction to the theory and practice of Bayesian inference. Prior and posterior probability distributions. Data collection, model formulation, computation, model checking, sensitivity analysis.

S631 Applied Linear Models I (3 cr.) P: STAT S320 and MATH M301 or M303 or S303 (or equivalent courses), or consent of instructor. Part I of a 2-semester sequence on linear models, emphasizing linear regression and the analysis of variance, including topics from the design of experiments and culminating in the general linear model.

S632 Applied Linear Models II (3 cr.) P: STAT S631, or consent of instructor. Part II of a 2-semester sequence on linear models, emphasizing linear regression and the analysis of variance, including topics from the design of experiments and culminating in the general linear model.

S637 Categorical Data Analysis (3 cr.) P: Two statistics courses at the graduate level, or consent of instructor. The analysis of cross classified categorical data. Loglinear models; regression models in which the response variable is binary, ordinal, nominal, or discrete. Logit, probit, multinomial logit models; logistic and Poisson regression. Equivalent to EDUC Y637.

S639 Multilevel Models (3 cr.) P: Two statistics courses at the graduate level, or consent of instructor. Introduction to the general multilevel model with an emphasis on applications. Discussion of hierarchical linear models, and generalizations to nonlinear models. How such models are conceptualized, parameters estimated and interpreted. Model fit via software. Major emphasis throughout the course will be on how to choose an appropriate model and computational techniques. Equivalent to EDUC Y639.

S640 Multivariate Data Analysis (3 cr.) P: Two statistics courses at the graduate level or consent of instructor. Elementary treatment of multivariate normal distributions, classical inferential techniques for multivariate normal data, including Hotelling's T^2 and MANOVA. Discussion of analytic techniques such as principal component analysis, canonical correlation analysis, discriminant analysis, and factor analysis. Equivalent to PSY P654.

S645 Covariance Structure Analysis (3 cr.) P: Two statistics courses at the graduate level, or consent of instructor. Path analysis. Introduction to multivariate multiple regression, confirmatory factor analysis, and latent variables. Structural equation models with and without latent variables. Mean-structure and multi-group analysis. Equivalent to EDUC Y645.

S650 Time Series Analysis (3 cr.) P: Two statistics courses at the graduate level, or consent of instructor. Techniques for analyzing data collected at different points in time. Probability models, forecasting methods, analysis in both time and frequency domains, linear systems, state-space models, intervention analysis, transfer function models and the Kalman filter. Stationary processes, autocorrelations, partial autocorrelations, autoregressive, moving average, and ARMA processes, spectral density of stationary processes, periodograms, estimation of spectral density. Course equivalent to MATH M568.

S655 Longitudinal Data Analysis (3 cr.) P: Two statistics courses at the graduate level, or consent of instructor. Introduction to methods for longitudinal data analysis; repeated measures data. The analysis of change—models for one or more response variables, possibly censored. Association of measurements across time for both continuous and discrete responses. Course is equivalent to EDUC Y655.

S660 Sampling (3 cr.) P: Two statistics courses at the graduate level, or consent of instructor. Design of surveys and analysis of sample survey data. Simple random sampling, ratio and regression estimation, stratified and cluster sampling, complex surveys, nonresponse bias.

S670 Exploratory Data Analysis (3 cr.) P: Two statistics courses at the graduate level, or consent of instructor. Numerical and graphical techniques for summarizing and displaying data. Exploration versus confirmation. Connections with conventional statistical analysis and data mining. Applications to large data sets.

S675 Statistical Learning and High-Dimension Analysis (3 cr.) P: STAT S640, or two statistics courses at the graduate level, or consent of instructor. Dataanalytic methods for exploring the structure of high-dimensional data. Graphical methods, linear and nonlinear dimension reduction techniques, manifold learning. Supervised, semisupervised, and unsupervised learning.

S681 Topics in Applied Statistics (3 cr.) P: Consent of instructor. Careful study of a statistical topic from an applied perspective. May be repeated with different topics.

S682 Topics in Mathematical Statistics (3 cr.) P: Consent of instructor. Careful study of a statistical topic from a theoretical perspective. May be repeated with different topics.

S690 Statistical Consulting (4 cr.) P: Consent of instructor. Development of effective consulting skills, including the conduct of consulting sessions, collaborative problem-solving, using professional resources, and preparing verbal and written reports. Interactions with clients will be coordinated by the Indiana Statistical Consulting Center.

S695 Readings in Statistics (1-3 cr.) P: Consent of instructor. Supervised reading of a topic in statistics. May be repeated with different topics.

S710 Statistical Computing (3 cr.) P: STAT S620, or consent of instructor. Survey of numerical methods in statistics. Matrix factorizations and algorithms for linear regression. Nonlinear optimization, maximum likelihood and nonlinear regression. Pseudorandom number generation and Monte Carlo methods.

S721 Advanced Statistical Theory I (3 cr.) P: S620, some knowledge of elementary measure theory, and/or consent of the instructor. Mathematical introduction to major areas of statistical theory and practice, including statistical models, sufficiency, likelihood inference, estimation and testing, Bayesian inference, decision theory, equivariance, and optimality of test statistics.

S722 Advanced Statistical Theory II (3 cr) P: S721 or consent of the instructor. A continuation of S721. A mathematical introduction to major areas of statistical theory and practice including multinomial models, canonical linear models, exponential families, asymptotic theory, and general linear models.

S730 Theory of Linear Models (3 cr.) P: STAT S620, or consent of instructor. Theory of the general linear model. Distribution theory, linear hypotheses, the Gauss-Markov theorem, testing and confidence regions. Application to regression and to analysis of variance.

S740 Multivariate Statistical Theory (3 cr.) P: STAT S721 and S722, or consent of the instructor. Multivariate normal distributions. Multivariate linear normal models, estimation and testing. Wishart distributions and models. Inference for the covariance matrix. Eigenvalues, including canonical correlations and principal components/factor analysis.

S781 Advanced Topics in Applied Statistics (3 cr.) P: Consent of the instructor. Careful study of an advanced statistical topic from an applied perspective. As topics vary, this course may be repeated for credit.

S782 Advanced Topics in Mathematical Statistics (3 cr.) P: Consent of the instructor. Careful study of an advanced statistical topic from a mathematical or theoretical perspective. As topics vary, this course may be repeated for credit.

S799 Research in Statistics (1-6 cr.) P: Consent of the instructor. Research in statistics.