- SOCI 300 Modern Sociological Thought
- SOCI 303 Social Research Methods
- SOCI 392 Senior Capstone Experience
- STAT 201 or PSCL 282 Statistics

Plus 15 hours of electives, consisting of any six courses in sociology SOCI 375, Independent Study, is available to selected majors in their junior or senior year.

Minor

The minor consists of 15 credit hours in sociology, including;

- SOCI 112B Introduction of Sociology: Human Interaction
- SOCI 300 Modern Sociological Thought
- plus three additional electives, of which at least two must be 300 level courses.

SOCIOLOGY SEQUENCE FOR ENGINEERING MAJORS

Choose on the these sequences and any two courses listed in parentheses:

A. Social Institutions
- SOCI 112B or 113 (SOCI 204, 300, 320, 328, 333, 349)

B. Human Behavior
- SOCI 112B or 113 (SOCI 203, 208, 222, 361, 369)

Departmental Honors

Juniors majoring in sociology with a 3.0 overall G.P.A. and a 3.4 G.P.A. in sociology are invited to apply for the department's Honors Program, which consists of an intensive, yearlong investigation of a research problem under the guidance of a faculty member. Students will earn credit through registration in SOCI 397 and SOCI 398. Admission to honors work is by faculty approval.

HONOR SOCIETY

The opportunity to join Alpha Kappa Delta (AKD), the sociology honors fraternity, is available to selected juniors and seniors (Membership requires a 3.4 G.P.A. in sociology and a 3.2 G.P.A. overall.)

Integrated Graduate Studies

The Department of Sociology participates in the Integrated Graduate Studies Program. Students in the program are able to obtain B.A. and M.A. degrees simultaneously. Interested students should note the general requirements and the admission procedures in the appropriate section of this bulletin and may consult the department for further information.

GRADUATE PROGRAM

The Department of Sociology offers graduate training leading to the Doctor of Philosophy degree. Students may petition for a Master of Arts degree, once they fulfill the requirements outlined below. Sociology of Aging and Medical Sociology are the major areas of emphasis in the department.

Master of Arts

To receive the Masters of Arts degree, a student must successfully complete 27 credit hours of course work. Required courses for the degree are SOCI 400 and 406 and either 401 or 407 plus 469 and 443 and four general electives in sociology. In addition, the student must pass one written comprehensive examination in Sociology of Aging, Medical Sociology or Research Methods.

Doctor of Philosophy

The Doctor of Philosophy degree is awarded upon the completion of all requirements of the School of Graduate Studies and the following departmental requirements: Completion of 63 credit hours past the Bachelor of Arts degree, including 18 credits of 701 (dissertation hours). Required courses are SOCI 400, 401, 406, 407, 443, 469, two additional electives in research methods, two additional electives in medical sociology, two additional electives in aging, and three general electives in sociology. In addition, students must pass two comprehensive examinations -- aging and medical sociology -- and successfully defend the dissertation. A predoctoral training program in Health Research and Aging sponsored by the National Institute of Aging has been offered in conjunction with the Elderly Care Research Center of the Department of Sociology.

RESEARCH PROGRAMS

The Elderly Care Research Center

Funded research projects of the center focus on theory-based and public policy relevant issues in aging and medical sociology. Current projects relate to physical and mental health outcomes of stress, coping, cancer survivorship and adaptation to frailty and life-threatening illness in late life. The center is recipient of an NIA Merit Award for a long-term study of very old residents of a retirement community. This research seeks to understand health promotion, proactive adaptation, and maintenance of wellness in late life. Major research projects focusing on medical sociology deal with life-threatening illness, caregiver burden, and physician-patient interactions. The center serves as a laboratory for student research. Collaborative and cross-national research involves colleges from other disciplines and universities in Israel, Hungary, Britain, and Germany.

Cancer Survivor Research Program

Conducted at the Sociology Department of Case Western Reserve University, the Cancer Survivors Research Program (CSRP) investigates important research issues in psychological oncology. Formally started in September 1998, the CSRP had been funded for ten years by the National Cancer Institute. Dr. Gary Deimling serves as the CSRP's director and principle investigator and is assisted by colleagues in the Department of Sociology and the Case School of Medicine. As with many other research programs within the department and the university at large, the CSRP also serves as a teaching facility by training graduate students in the many methodological and theoretical aspects of sociomedical research. The project allows students in the Sociology Ph.D. program to gain hands-on experience in a formal research setting while putting their coursework into practices.

DEPARTMENT OF STATISTICS

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Statistics links mathematics to other disciplines to understand uncertainty and probability in the abstract and in the context of actual applications to science, edicine, actuarial science, social science, management science, business, engineering, and to contemporary life. As technology brings advances, the statistical theory and methodology required to do them justice becomes more challenging: higher dimensional, dynamic, or computer-intensive. The field of statistics is rapidly expanding to meet the three facets of these challenges: the underlying mathematical theory, the data analysis and modeling methodology, and the interdisciplinary collaborations and new fields of application.

FACULTY

Wojbor Woyczynski, Ph.D.
(Wroclaw University, Poland)
Professor
Stochastic models, probability, random fields, time series, dynamics of chaotic processes, nonlinear diffusion, turbulence

Paula FitzGibbon, M.S. (Miami University)
Lecturer

Catherine Loader, Ph.D.
(Stanford University)
Associate Professor
Local regression and likelihood; mixture models; functional data analysis and application to biological data; numerical algorithms in statistics and applied probability; boundary crossing problems and statistical applications.

Ramani Pilla, Ph.D. (Penn State)
Assistant Professor
Bioinformatics/genetics, correlated data (clustered and longitudinal); estimating equations; mixture models (nonparametri and semiparametric); random effects models; random fields; statistical computation; spatial scan analysis

Joseph Sedransk, Ph.D. (Harvard University)
Professor
Bayesian inference, sample survey theory, methodology and applications

Jiayang Sun, Ph.D. (Stanford University)
Professor
General statistics and applications; methodologies in statistical computing and data mining; semi- and nonparametrics, biased sampling, bump hunting and mixtures; statistics in astronomy, neuroscience, imaging and information technology research

Lajos Takacs, Ph.D. (Budapest University)
Professor Emeritus
Stochastic processes, probability, queuing systems

Adjunct Faculty

Mary H. Regier, Ph.D.
(University of California at Berkeley)
Adjunct Professor

UNDERGRADUATE (STAT)

STAT 201. Basic Statistics for Social and Life Sciences (3)
Designed for undergraduates in the social sciences and life sciences who need to use statistical techniques in their fields. Descriptive statistics, probability models, sampling distributions. Point and confidence interval estimation, hypothesis testing. Elementary regression and analysis of variance. Not for credit toward major or minor in Statistics.

STAT 207. Statistics for Business and Management Science I (3)
Organizing and summarizing data. Mean, variance, moments. Elementary probability, conditional probability. Commonly encountered distributions including binomial, Poisson, uniform, exponential, normal distributions. Central limit theorem. Sample quantities, empirical distributions. Reference distributions (chi-square, z-, t-, F-distributions). Point and interval estimation; hypothesis tests. Prereq: MATH 122 or MATH 126 or equivalent.

STAT 208. Statistics for Business and Management Science II (3)
Hypothesis testing, analysis of variance. Simple linear regression and correlation; multiple linear regression. Analysis of contingency table data, goodness-of-fit tests. Nonparametric methods including sign, Wilcoxon, Kruskal-Wallis and runs tests. Introduction to time series analysis and forecasting. Prereq: STAT 207.

STAT 243. Statistical Theory with Application I (3)
Introduction to fundamental concepts of statistics through examples including design of an observational study, industrial simulation. Theoretical development motivated by sample survey methodology. Randomness, distribution functions, conditional probabilities. Derivation of common discrete distributions. Expectation operator. Statistics as random variables, point and interval estimation. Maximum likelihood estimators. Properties of estimators. Prereq: MATH 122 or MATH 126.

STAT 244. Statistical Theory with Application II (3)
Extension of inferences to continuous-valued random variables. Common continuous-valued distributions. Expectation operator. Maximum likelihood estimators for the continuous case. Simple linear, multiple and polynomial regression. Properties of regression estimators when errors are Gaussian. Regression diagnostics. Class or student projects gathering real data or generating simulated data, fitting models and analyzing residuals from fit. Prereq: STAT 243.

STAT 312. Basic Statistics for Engineering and Science (3)
For advanced undergraduate students in engineering, physical sciences, life sciences. Comprehensive introduction to probability models and statistical methods of analyzing data with the object of formulating statistical models and choosing appropriate methods for inference from experimental and observational data and for testing the model's validity. Balanced approach with equal emphasis on probability, fundamental concepts of statistics, point and interval estimation, hypothesis testing, analysis of variance, design of experiments, and regression modeling. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Prereq: MATH 122 or equivalent.

STAT 313. Statistics for Experimenters (3)
For advanced undergraduates in engineering, physical sciences, life sciences. Comprehensive introduction to modeling data and statistical methods of analyzing data. General objective is to train students in formulating statistical models, in choosing appropriate methods for inference from experimental and observational data and to test the validity of these models. Focus on practicalities of inference from experimental data. Inference for curve and surface fitting to real data sets. Designs for experiments and simulations. Student generation of experimental data and application of statistical methods for analysis. Critique of model; use of regression diagnostics to analyze errors. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Prereq: MATH 122 or equivalent.

STAT 317. Actuarial Science I (3)
Practical knowledge of the theory of interest in both finite and continuous time. That knowledge should include how these concepts are used in the various annuity functions, and apply the concepts of present and accumulated value for various streams of cash flows as a basis for future use in: reserving, valuation, pricing, duration, asset/liability management, investment income, capital budgeting, and contingencies. Valuation of discrete and continuous streams of payments, including the case in which the interest conversion period differs from the payment period will be considered. Application of interest theory to amortization of lump sums, fixed income securities, depreciation, mortgages, etc., as well as annuity functions in a broad finance context will be covered. Topics covered include areas examined in the American Society of Actuaries Exam 2. Prereq: MATH 122 or MATH 126 or equivalent.

STAT 318. Actuarial Science II (3)
Theory of life contingencies. Life table analysis for simple and multiple decrement functions. Life and special annuities. Life insurance and reserves for life insurance. Statistical issues for prediction from actuarial models. Topics covered include areas examined in the American Society of Actuaries Exam 3. Prereq: STAT 317 and one of the following: STAT 207, 312, 345, or equivalent.

STAT 325. Data Analysis and Linear Models (3)
Basic exploratory data analysis for univariate response with single or multiple covariates. Graphical methods and data summarization, model-fitting using S-plus computing language. Linear and multiple regression. Emphasis on model selection criteria, on diagnostics to assess goodness of fit and interpretation. Techniques include transformation, smoothing, median polish, robust/resistant methods. Case studies and analysis of individual data sets. Notes of caution and some methods for handling bad data. Knowledge of regression is helpful. Prereq: Permission of department.

STAT 326. Multivariate Analysis and Data Mining (3)
Extensions of exploratory data analysis and modeling to multivariate response observations and to non-Gaussian data. Singular value decomposition and projection, principal components, factor analysis and latent structure analysis, discriminant analysis and clustering techniques, cross-validation, E-M algorithm, CART. Introduction to generalized linear modeling. Case studies of complex data sets with multiple objectives for analysis. Prereq: STAT 325.

STAT 332. Statistics for Signal Processing (3)
For advanced undergraduate students in engineering, physical sciences, life sciences. Introduction to probability models and statistical methods. Emphasis on probability as relative frequencies. Derivation of conditional probabilities and memoryless channels. Joint distributions of random variables, transformations, autocorrelation, series of irregular observations, stationarity. Random harmonic signals with noise, random phase and/or random amplitude. Gaussian and Poisson signals. Modulation and averaging properties. Transmission through linear filters. Power spectra, bandwidth, white and colored noise, ARMA processes and forecasting. Optimal linear systems, signal-to-noise ratio, Wiener filter. Prereq: MATH 122.

STAT 333. Uncertainty in Engineering and Science (3)
Phenomena of uncertainty appear in engineering and science for various reasons and can be modeled in different ways. The course integrates the mainstream ideas in statistical data analysis with models of uncertain phenomena stemming from three distinct viewpoints: algorithmic/computational complexity; classical probability theory; and chaotic behavior of nonlinear systems. Descriptive statistics, estimation procedures and hypothesis testing (including design of experiments). Random number generators and their testing. Monte Carlo Methods. Mathematica notebooks and simulations will be used. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Prereq: MATH 122.

STAT 345. Theoretical Statistics I (3)
Topics provide the background for statistical inference. Random variables; distribution and density functions; transformations, expectation. Common univariate distributions. Multiple random variables; joint, marginal and conditional distributions; hierarchical models, covariance. Distributions of sample quantities, distributions of sums of random variables, distributions of order statistics. Methods of statistical inference. Prereq: MATH 122 or MATH 223.

STAT 346. Theoretical Statistics II (3)
Point estimation: maximum likelihood and moment estimators. Methods of evaluating estimators including mean squared error, consistency, "best" unbiased and sufficiency. Hypothesis testing: likelihood ratio, and union-intersection tests. Properties of tests including power function, bias. Interval estimation by inversion of test statistics, use of pivotal quantities. Application to regression. Prereq: STAT 345.

STAT 395. Senior Project in Statistics (3)
An individual project done under faculty supervision involving the investigation and statistical analysis of a real problem encountered in university research or an industrial setting. Written report. Prereq: Permission of department.

STAT 401. Statistics for Social and Life Sciences (3)
Principles and practice of data presentation and basic models including analysis of variance and multiple linear regression. Content includes analysis of discrete data in contingency tables, sensitivity and specificity, odds ratios, tests of goodness of fit, display and summarization of data, hypothesis testing, and interval estimation. Taught in case-based format with individual and/or collaborative student projects. Primarily for graduate students in nursing and health sciences. Not for credit toward undergraduate major or minor in Statistics or for credit toward any graduate degree in Statistics. Prereq: STAT 201.

STAT 412. Statistics for Design and Analysis in Engineering and Science (3)
For graduate students (primarily) and advanced undergraduates in engineering, physical sciences, and life sciences. After basic statistical concepts are reviewed, the remainder of the course consists of a comprehensive introduction to statistical methods of designing experiments and analyzing data. The general objective is to train students in statistical modeling and in the choice of experimental designs to use in scientific investigations. A variety of experimental designs are covered, and regression analysis is presented as the primary technique for analyzing data from designed experiments, and in discriminating between various possible statistical models. The course is oriented toward graduate students engaged in or embarking on research. Prereq: MATH 122 (an introductory statistics course is recommended).

STAT 417. Actuarial Science I (3)
(See STAT 317.)

STAT 418. Actuarial Science II (3)
(See STAT 318.)

STAT 425. Data Analysis and Linear Models (3)
Basic exploratory data analysis for univariate response with single or multiple covariates. Graphical methods and data summarization model-fitting using S-plus computing language. Linear and multiple regression. Emphasis on model selection criteria, on diagnostics to assess goodness of fit and interpretation. Techniques include transformation, smoothing, median polish, robust/resistant methods. Case studies and analysis of individual data sets. Notes of caution and some methods for handling bad/biased data. Knowledge of regression is helpful. Prereq: Permission of department.

STAT 426. Multivariate Analysis and Data Mining (3)
(See STAT 326.)

STAT 427. Statistical Computing (3)
Basic topics in statistical computing: floating point arithmetic; seminumerical computation including generation and test of random numbers, Monte Carlo methods, variance reduction methods, stochastic models and simulation studies; numerical computation including numerical linear algebra, optimization and root-rinding, numerical integration; some graphical and symbolic computations, special topics in statistical computing: resampling methods, EM algorithms, Gibbs sampling and projection pursuit. Prereq: STAT 345 or STAT 425 or permission of department.

STAT 432. Statistics for Signal Processing (3)
For beginning graduate students in engineering, physical sciences, life sciences. Introduction to probability models and statistical methods. Emphasis on probability as relative frequencies. Derivation of conditional probabilities and memoryless channels. Joint distribution of random variables, transformations, autocorrelation, series of irregular observations, stationarity. Random harmonic signals with noise, random phase and/or random amplitude. Gaussian and Poisson signals. Modulation and averaging properties. Transmission through linear filters. Power spectra, bandwidth, white and colored noise. ARMA processes and forecasting. Optimal linear systems, signal-to-noise ratio, Wiener filter. Completion of additional assignments required from graduate students registered in this course. Prereq: MATH 122.

STAT 433. Uncertainty in Engineering and Science (3)
Phenomena of uncertainty appear in engineering and science for various reasons and can be modeled in different ways. The course integrates the mainstream ideas in statistical data analysis with models of uncertain phenomena stemming from three distinct viewpoints: algorithmic/computational complexity; classical probability theory; and chaotic behavior of nonlinear systems. Descriptive statistics, estimation procedures and hypothesis testing (including design of experiments). Mathematica notebooks and simulations will be used. Random number generators and their testing. Monte Carlo methods. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Graduate students are required to do an extra project. Prereq: MATH 223 or MATH 122.

STAT 437. Stochastic Modeling of Scientific Data (3)
Introduction to stochastic modeling of data. Emphasis on models and statistical analysis of data with a significant temporal and/or spatial structure. Markovian and semi-Markovian models, point processes, point cluster models, queuing models, likelihood methods, estimating equations. Note: Restricted to declared graduate and undergraduate majors and minors in Statistics and Biostatistics only. Prereq: STAT 333 or STAT 433 (preferred) or STAT 325, STAT 425, or STAT 445, or permission of department.

STAT 439. Integrated Numerical and Statistical Computations (3)
(See MATH 439.) Cross-listed as MATH 439.

STAT 445. Theoretical Statistics I (3)
Topics provide the background for statistical inference. Random variables; distribution and density functions; transformations, expectation. Common univariate distributions. Multiple random variables; joint, marginal and conditional distributions; hierarchical models, covariance. Distributions of

sample quantities: distributions of sums of random variables, distributions of order statistics. Methods of statistical inference. Graduate students are responsible for mathematical derivations, and full proofs of principal theorems. Prereq: MATH 122 or MATH 223. Cross-listed as EPBI 481.

STAT 446. Theoretical Statistics II (3)
Point estimation: maximum likelihood, moment estimators. Methods of evaluating estimators including mean squared error, consistency, "best" unbiased and sufficiency. Hypothesis testing; likelihood ratio and union-intersection tests. Properties of tests including power function, bias. Interval estimation by inversion of test statistics, use of pivotal quantities. Application to regression. Graduate students are responsible for mathematical derivations, and full proofs of principal theorems. Prereq: STAT 445. Cross-listed as EPBI 482.

STAT 448. Bayesian Theory with Applications (3)
Principles of Bayesian theory, methodology and applications. Methods for forming prior distributions using conjugate families, reference priors and empirically-based priors. Derivation of posterior and predictive distributions and their moments. Properties when common distributions such as binomial, normal or other exponential family distributions are used. Hierarchical models. Computational techniques including Markov chain, Monte Carlo and importance sampling. Extensive use of applications to illustrate concepts and methodology. Prereq: STAT 445.

STAT 453. Time Series and Wavelets I (3)
Stationary discrete-time and continuous-time models. Search for hidden periodicities in data. Fast Fourier transform; smoothing and filtering; spectra and periodograms. Multiple series; cross spectra and cross periodograms. Prediction problems. Time-frequency localization and the uncertainty principle, windowed Fourier transforms. Introduction to wavelet and multiresolution analysis. Prereq: One (1) of: STAT 333, 346, 433, 446, or permission of department.

STAT 455. Linear Models (3)
Theory of least squares estimation, interval estimation and tests for models with normally distributed errors. Regression on dummy variables, analysis of variance and covariance. Variance components models. Model diagnostics. Robust regression. Analysis of longitudinal data. Prereq: MATH 201 and STAT 346 or STAT 446.

STAT 491. Graduate Student Seminar (1-2)
Seminar run collaboratively by graduate students to investigate an area of current research, the topic chosen each semester. All graduate students participate in presentation of material each semester. Satisfies requirement for every full-time graduate student to enroll in a participatory seminar every semester while registered in any graduate degree program. Prereq: Graduate standing.

STAT 495A. Consulting Forum (1-3)
This course unifies what students have learned in their course work to apply their knowledge in consulting. It recognizes the fact that the essence of the statistical profession is continuing interaction with practitioners in the sciences, engineering, medicine, economics, etc. The course presents the views of prominent experts in the field as obtained from the literature and other sources. The responsibilities of the consultant and the client are discussed. Sample consulting problems are presented and strategies for solving them are provided. Prereq: STAT 325 or STAT 425.

STAT 495B. Consulting Forum With Practicum (3)
This course is designed to provide a hands-on experience with statistical consulting under the guidance of the instructor. It will include discussion of practical aspects of consulting such as the entrepreneurial nature of this activity. The students will become involved in actual consulting projects generated in a collaborative environment. Statistical problems, together with their substantive background, will be presented by individuals from the private sector (e.g., from industry) and/or CWRU faculty and students. Selected problems will be addressed in a collaborative fashion; i.e., by a team involving graduate students from the Statistics Department, the course instructor, and scientists. Some of these problems may lead to collaborative research or entrepreneurial ventures. Prereq: STAT 495A, STAT 325 or STAT 425 or consent of department.

STAT 525. Advanced Data Analysis (3)
Topics drawn from resampling methods (including bootstrapping), MCMC (Gibbs sampling), nonparametric curve and surface fitting, kernel density estimation, projection pursuit, mixture models, time series (time permitting), approaches to model uncertainty, models for repeated measures and structural-functional models, statistical inference for large systems, modern data analysis techniques. Prereq: STAT 426 or permission of department.

STAT 538. Advanced Stochastic Modeling of Scientific Data II (3)
Foundations of discrete and continuous-time dynamical systems. Complexity of nonlinear dynamical systems. Descriptive statistics of dynamical systems, invariant densities and their estimation. Ergodic properties, space and time-averaging. Chaotic behavior. Fractals as a signature of chaos. Statistical estimation of fractal dimension. Asymptotic fluctuations in dynamical systems. Statistical problems in physical sciences; statistical hydrodynamics. Statistical problems for hydrological, atmospheric and oceanic models. Theoretical foundations of simulation of random phenomena. Prereq: STAT 437, or permission of department.

STAT 545. Advanced Theory of Statistics I (3)
A systematic development of advanced statistical theory. Background concepts. Limits, order comparisons, convergence. Sample moments, quantiles and other statistics. Transformations. Characterization of distribution functions and characteristic functions. Normal and other approximations to distributions. Quadratic forms and other functions of asymptotically normal statistics. Asymptotic properties of statistics including asymptotic efficiency, consistency. Admissibility, sufficiency and ancillarity. Nuisance parameters, parameter orthogonality. Distribution theory in nuisance parameters. Prereq: STAT 446.

STAT 546. Advanced Theory of Statistics II (3)
Estimation: maximum likelihood, minimax, Bayes', empirical Bayes', and James-Stein estimators. Entropy and information. U-statistics and their distributions. Von Mises differentiable statistical functions, M, L, R-estimators. Confidence intervals and regions. Simple and weighted empirical processes. Convergence and distributions for empirical processes. Prereq: STAT 545.

STAT 555. Generalized Linear Models (3)
Generalization from linear statistical models to discrete responses and other non-Gaussian cases. Theory for binomial proportions and logits, Poisson counts and loglinear models, multinomial response models, models for survival data. Analysis of deviance, model checking. Conditional, marginal and quasi-likelihood methods. Inverse linear models. Generalized linear mixed models. Prereq: STAT 455.

STAT 571. Advanced Topics in Statistics (1-3)
For advanced graduate students. Topics in specialized areas of statistical theory and methodology, with emphasis on recent advances in theory, developments of new methodology and definition of new research questions. Topics may change from year to year. Number of credit hours for the class will be predetermined each semester based on the material to be presented. Prereq: Permission of department.

STAT 576. Advanced Topics in Modeling (1-3)
Advanced topics in specialized areas of statistics and stochastic modeling designed to define new research directions drawing on recent advances in theory and model formulation. Focus on statistical issues arising in the application of statistical or stochastic models to new substantive research efforts. Topics may change from year to year. Number of credit hours for the class will be predetermined each semester based on the material to be presented. Prereq: Permission of department.

STAT 601. Reading and Research (1-9)
Individual study and/or project work. Prereq: Permission of department.

STAT 621. M.S. Research Project (1-9)
Completion of statistical design and/or analysis of a research project in a substantive field which requires substantial and/or nonstandard statistical techniques and which leads to results suitable for publication. Written project report must present the context of the research, justify the statistical methodology used, draw appropriate inferences and interpret these inferences in both statistical and substantive scientific terms. Oral presentation of research project may be given in either graduate

student seminar or consulting forum. Prereq: Permission of department.

STAT 651. Thesis M.S. (1-18)
(Credit as arranged.) May be used as alternative to STAT 621 (M.S. Research Project) in fulfillment of requirements for M.S. degree in Statistics. Prereq: Permission of department.

STAT 701. Dissertation Ph.D. (1-18)
(Credit as arranged.) Prereq: Permission of department.

Students in statistics begin with a foundation in mathematics, then add statistical theory, plus intensive modern data analysis and a concentration in a field of each student's choice where statistics is used. The goal is to develop an appreciation of each facet of the discipline and a mastery of technical skills. This prepares students to enter a growing profession with opportunities in the academic, governmental, actuarial, and industrial spheres. For the undergraduate student looking toward graduate school, the course of study within these guidelines easily incorporates additional mathematics in preparation for the more abstract mathematical level of graduate courses. The more specialized option in actuarial science expands the basic program in statistics to incorporate topics from operations research and numerical analysis which are fundamental to actuarial theory and computation. This actuarial option includes the course work necessary to prepare for Courses 1-3 of the Society of Actuaries Exams. All undergraduate majors begin with a foundation in mathematics and a core of courses in mathematical statistics, courses in statistical methodology and courses in modern data analysis. Each student's program is individualized by the choice of an applied field of concentration according to the student's own talents and interests and by the choice of appropriate STAT electives which may be drawn from offerings by the Statistics Department and from suitable offerings by other departments at the University. The Senior Project option also allows students either to work in a research setting or to participate in interdisciplinary collaboration or in industrial consulting along with a statistics faculty member. The B.A. degree offers flexibility and the chance to pursue a wider range of interests. It also offers the possibility of expanding the interdisciplinary aspect of the program to complete the requirements for majors in two fields. Some examples of particularly attractive double majors combine statistics with computer science, biology (molecular, organismal or ecology), psychology, economics, accounting, or management science.

The, B.S. degree adds a laboratory science requirement. For students seriously interested in basic science, a natural science is the logical choice as a focus for the application, and the, B.S. degree is the logical choice of program. Bachelor of Science in Statistics The, B.S. degree in statistics requires a minimum of 124 hours, including at least 68 hours of approved course work, including 27 hours in statistics, the remainder in related disciplines and a substantive field of application, to satisfy the following requirements:

(1) MATH 121, 122, 223, 224, and 201 or equivalent;
(2) ENGR 131 or ECMP 251 or approved alternate; plus an additional higher numbered course in computation from ENGR or ECMP offerings or EPBI 414 or EPBI 420;
(3) STAT 325 and 326, STAT 345 and 346;
(4) At least 15 hours of courses in statistical methodology to be chosen from statistics courses numbered 300 and higher offered by the Statistics Department, or approved courses in statistical methodology or probability taught in biostatistics, computer science, economics, mathematics, operations research, systems engineering, etc. At least 6 hours must be in STAT courses; STAT 243 and 244 may be counted;

PROTOTYPE PROGRAMS STATISTICS COURSEWORK

Statistics B.A. Program

Year 1
Fall
MATH 121
CMPS 131
ENGL 150
GER: Science
GER: Social Science
Physical Education Requirement
Total: 16 hours

Spring
MATH 122
GER: Arts and Humanities
GER: Science
GER: Social Sciences
Free Elective
Physical Education Requirement
Total: 16 hours

Year 2
Fall
MATH 223
STAT 243
GER: Arts and Humanities
GER: Social Sciences
Free Elective
Total: 15 hours

Spring
MATH 224
MATH 201
STAT 244
GER: Arts and Humanities
GER: Global and Cultural Diversity
Total: 15 hours

Year 3
Fall
STAT 345
EPBI 420
Substantive Field Requirement
GER: Arts and Humanities
Free Elective
Total: 15 hours

Spring
STAT 346
STAT Elective
Substantive Field Requirement
Free Elective
Free Elective
Total: 15 hours

Year 4
Fall
STAT 325
STAT Elective
Free Elective
Free Elective
Free Elective
Total: 15 hours

Spring
STAT 326
STAT 395
STAT 391
Free Elective
Free Elective
Total: 13 hours

(5) Two approved courses (or more) numbered 300 or above in an approved discipline outside statistics;

(6) A combined total of 12 hours (or more) in ASTR, BIOL, CHEM, GEOL, PHYS which may be counted toward a major in that field including at least one of PHYS 121 and 122, CHEM 105 and 106 plus 113, CHEM 107 and 108 plus 113, BIOL 110 and 210 plus 211, BIOL 110 and 220 plus 221. Students are strongly encouraged to include advanced expository or technical writing courses in their programs.

Bachelor of Arts

The B.A. degree in statistics requires a minimum of 120 hours, including at least 56 hours of approved course work, including 27 hours in statistics, the remainder in related disciplines and a substantive field of application, to satisfy the following requirements:

(1) MATH 121, 122, 223, 224, and 201 or equivalent;
(2) ENGR 131 or ECMP 251 or approved alternate; plus an additional higher numbered course in computation from ENGR or ECMP offerings or EPBI 414 or EPBI 420;
(3) STAT 325 and 326, STAT 345 and 346;
(4) At least 15 hours of courses in statistical methodology to be chosen from statistics courses numbered 300 and higher offered by the Statistics Department, or approved courses in statistical methodology or probability taught in biostatistics, computer science, economics, mathematics, operations research, systems engineering, etc. At least 6 hours must be in STAT

STATISTICS

B.S. Program

Year 1
Fall
MATH 121
MATH 122
ENGR 131
ENGL 150
GER: Science
GER: Social Sciences
Physical Education Requirement
Total: 16 hours

Spring
GER: Arts and Humanities
GER: Science
GER: Social Sciences
Free Elective
Physical Education Requirement
Total: 16 hours

Year 2
Fall
MATH 223
STAT 243
GER: Arts and Humanities
GER: Social Sciences
Free Elective
Total: 15 hours

Spring
MATH 224
MATH 201
STAT 244
GER: Arts and Humanities
GER: Global and Cultural Diversity
Total: 15 hours

Year 3
Fall
STAT 345
EPBI 420
Substantive Field Requirement
GER: Arts and Humanities
Science Requirement
Total: 15 hours

Spring
STAT 346
STAT Elective
Substantive Field Requirement
Free Elective
Science Requirement
Total: 15 hours

Year 4
Fall
STAT 325
STAT Elective
STAT 391
Free Elective
Free Elective
Free Elective
Total: 16 hours

Spring
STAT 326
STAT 395
STAT 391
Free Elective
Free Elective
Free Elective
Total: 16 hours

STATISTICS

Combined, B.S./M.S. Program

Year 1
Fall
MATH 121
ECMP 251
ENGL 150
GER: Science
GER: Social Sciences
Physical Education Requirement
Total: 16 hours

Spring
MATH 122
GER: Arts and Humanities
GER: Science
GER: Social Sciences
Free Elective
Physical Education Requirement
Total: 16 hours

Year 2
Fall
MATH 223
STAT 243
STAT GER: Arts and Humanities
GER: Social Science
Science Requirement
Total: 15 hours

Spring
MATH 224
MATH 201
STAT 244
GER: Arts and Humanities
Science Requirement
Total: 15 hours

Year 3
Fall
STAT 345/445
EPBI 420
Substantive Field Requirement
GER: Arts and Humanities
Free Elective
Total: 15 hours

Spring
STAT 346
STAT Elective
Substantive Field Requirement
GER: Global and Cultural Diversity
Free Elective
Total: 15 hours

Year 4
Fall
STAT 425
STAT Elective
STAT 491 (1)
Free Elective
Free Elective
Free Elective
Total: 16 hours

Spring
STAT 426
STAT Elective
STAT 491 (1)
Free Elective
Free Elective
Free Elective
Total: 16 hours

Year 5
Fall
STAT 455
STAT Elective
STAT 491 (1)
Free Elective
Total: 10 hours

Spring
STAT Elective
STAT Elective
STAT 651
STAT 491 (1)
STAT 495 (3)
Total: 13 hours

Statistics courses; STAT 243 and 244 may be counted;

(5) Two approved courses (or more) numbered 300 or above in an approved discipline outside statistics. Students are strongly encouraged to include advanced expository or technical writing courses in their programs. Students may pursue a B.A. with double major in statistics and a related field from within the College of Arts and Sciences. In this case, the substantive field requirement (No. 5 above) is waived.

Bachelor Degrees - Option in Actuarial Science

The actuarial program leading to a either B.A. or a, B.S. in statistics requires 30 hours in statistics and actuarial studies and must satisfy the requirements for the appropriate degree program with the following modifications of requirements (4) and (5) of the B.A. or, B.S. program:

(4) At least 12 hours of courses in statistical methodology to be chosen from statistics courses numbered 300 and higher offered by the Statistics Department, or approved courses taught in biostatistics, computer science, economics, mathematics, operations research, systems engineering, etc. At least 6 hours must be in STATcourses; STAT 243 and 244 may be ounted;
(5) STAT 317 and STAT 318. Students ordinarily can expect to be prepared to take Courses 1-3 of the Society of Actuaries Exams upon graduation.

Minor in Statistics

A minor in statistics requires a minimum of 15 hours of approved course work in statistics. The minor must satisfy the requirements below and must include a minimum of 9 credits in courses from the Statistics Department offerings.

(1) STAT 243 and 244 or STAT 345 and 346 or other approved sequence
(2) STAT 208 or STAT 312 or STAT 313 or STAT 332 or STAT 333 or STAT 325
(3) Two approved elective courses in statistics numbered 300 or above. Combined Bachelor-Master Degrees The combined bachelor-master degrees in statistics require a minimum of 21 hours beyond the bachelor's degree requirements. In total, 42 hours must be in statistics, including an M.S. thesis or M.S. research project, with the remainder (either 41 or 26 hours for, B.S. or B.A., respectively) in approved course work in related disciplines and a field of application.

In addition to the, B.S. or B.A. requirements, a combined degree program must include:

(1) STAT 455 and three semesters of STAT 491;
(2) One semester of STAT 495
(3) M.S. research project (STAT 621) or M.S. Thesis (STAT 651);
(4) At least 6 additional hours of courses in statistical theory and methodology (making a total of 21 hours including at least 4 STAT courses numbered 400 or higher) to be chosen from Statistics Department offerings numbered 300 and higher, or approved courses in statistical methodology or probability taught in biostatistics, computer science, economics, mathematics, operations research, systems engineering, etc. Students are strongly encouraged to include advanced expository or technical writing courses in their programs.

GRADUATE PROGRAMS

The department offers programs leading o the Master of Science and to the Doctor of Philosophy degrees. Graduate assistantships both with teaching responsibilities nd with research duties are available to qualified applicants.

The dual core of the M.S. program is mathematical statistics and modern data analysis with the option of a special Entrepreneurial Track. Expanding from this core, students develop technical facility in a variety of statistical methodologies. This breadth of competence is designed to equip graduates to go beyond the appropriate choice of method for implementation and to be able to adapt these techniques and to construct new methods to meet the specific objectives and constraints of new situations.

Master of Science in Statistics

The M.S. degree in statistics requires a minimum of 27 hours of approved course work in statistics and related disciplines and an M.S. research project or a thesis. Each student's program is developed in consultation with the Director of Graduate Studies or a senior faculty mentor and must satisfy the following requirements:

(1) STAT 425 and 426;
(2) STAT 445 and 446;
(3) STAT 455
(4) STAT 495 (3 credits);
(5) M. S. research project (STAT 621) or M.S. Thesis (STAT 651);
(6) A minimum of 6 hours of approved graduate level statistics electives.
(7) STAT 491 (0 credits)

The goals of this program are to give each student a balanced view of statistical theory and the application of statistics in practice or in substantive research and at the same time to have the student develop a broad competence in statistical methodology. The required core course work reflects this balance. The first two requirements are for full-year sequences in data analysis and theory; and the third develops the theory underlying linear modeling. The requirement for applications of statistics will be satisfied through intensive participation in the Consulting Forum; selecting an M.S. research project provides additional exposure. Graduate students are also required to participate in a forum or seminar to gain experience in written and oral presentation. The remainder of each student's program is individualized to address the more specialized statistical demands of the selected field of concentration or the focus of multi disciplinary work. Each student may choose either the applied research project or the thesis option depending on individual interests. In either case the student can expect to work with a faculty mentor in undertaking a significant task which will culminate in polished written and oral presentations; in many cases the work will be suitable for presentation at professional society meetings or publishable in a substantive literature. A student coming to school from a position as professional statistician might choose a statistical problem arising in the workplace as the basis for an M.S. research project. A student intending to continue graduate work toward a Ph.D. might choose an M.S. research project to explore the intimate relationship of statistics to substantive fields. Alternatively, either student might choose the thesis option to tailor methodology to a new setting or to make a first essay at mathematical statistical research.

Master of Science in Statistics
ENTREPRENUERIAL TRACK

The Master of Science in Statistics-Entrepreneurial Track (MSS-ET) is a professional degree designed to provide training in statistics focused on developing data analysis and decision-making skills in industrial/government/consulting environments where uncertainties and related risks are present. It expands our basic Master of Statistics program by creating a professional-type track which provides some business training. The Entrepreneurial Track provides instruction and real business-world experience to students who have a background in statistics and a vision for new and growing ventures.

The minimum number of hours required for the MSS-ET program is 27. A typical curriculum to be followed is listed below but variance could be granted at departmental discretion.

Year 1
Fall
Data Analysis I
Theoretical Statistics I
New Venture Creation

Spring
Data Analysis II
Theoretical Statistics II
Technology Entrepreneurship

Year 2
Fall
Statistical Computing
Linear Models
Consulting Forum/Internship

Spring
Elective or Actuarial Science I or Actuarial Science II
MS Project or Experimental Design
Consulting Forum w/Practicum/ Internship

The required New Venture Creation and Technology Entrepreneurship courses will be offered by the Weatherhead School of Management. Students on internships will sign up for the Consulting Forum sequence.

In addition, students are required to participate in an intensive one-week annual workshop on the industrial use of statistics from the management perspective. The up to 30 hour (no credit) workshop will take place during the fall or spring undergraduate breaks.

Doctor of Philosophy in Statistics

The focus of the doctoral program is on Research, and the plan of study emphasizes the theory of statistics so that graduates from this program will be able both to extend the theoretical basis for statistics and to bring statistical thought to scientific research in other fields. The objective of preparing students to collaborate in interdisciplinary work demands breadth as well, so advanced knowledge of a substantive field and participation in the collaborative experience are also integral to the program.

Students planning to enter the doctoral program in statistics should obtain information from the departmental office. Plans of study are prepared individually by the graduate student and a faculty advisor to develop the talents and interests of each student.

TEACHER EDUCATION

EDUC 301. Introduction to Education (3)
The historical, sociological, and philosophical role of education in a diverse society. Contemporary practices and issues are introduced, researched, and debated. Issues of professional development. Application of research to instructional methodologies. Clinical/Field experiences required.

EDUC 304. Educational Psychology (3)
Application of psychological principles as they relate to various educational learning theories. Principles and practices of measurement and evaluation. Learning developmental differences between child, adolescent, and young adult growth. Continuation of professional development. Application of research to instructional methodologies. Clinical/Field experiences required. Prereq: PSCL 101.

EDUC 338. Seminar and Practicum in Adolescents (3)
Supervised field placement and attendance in early childhood, child, and adolescent settings including preschools, schools, hospitals, and neighborhood centers. This class is used to fulfill requirements by the Ohio Department of Education teacher licensure program. Prereq: PSCL 101, EDUC 301, EDUC 304, and permission of program director. Cross-listed as PSCL 338 and SOCI 338.

EDUC 401. Introduction to Education (3)
(See EDUC 301.) Research project required for graduate students.

EDUC 404. Educational Psychology (3)
(See EDUC 304.) Research project required for graduate students. Prereq: PSCL 101

EDJC 186. Instructional Technology (2)
Principles and techniques of instructional design and use of technology in educational settings. Includes examination of emerging technologies and production of instructional materials. Lab fee required. Prereq: EDUC 301, EDUC 304, and EDUC 338.

EDJC 255. Literacy Across the Curriculum (3)
Literacy development examined through psychological, socio-cultural and historical perspectives. Examines reading as an interactive, problem-solving process. Strategies that foster critical thinking, active engagement and social interaction in the teaching of reading and writing across the curriculum. Includes field experience. Field assignments related to licensure and content area. Prereq: EDUC 301, EDUC 304, and EDUC 338.

EDJC 337. Adolescent Education Special Methods (3)
For Adolescent and Multi-Age licensure program students. General methods and specific content area methods for planning, implementing and integrating curriculum, evaluating pupil achievement, and teaching to individual differences. Aligned with Ohio Department of Education's Competency-Based Models, Praxis 2, INTASC, and learned Society Guidelines. Emphasis given to strategies related to effective teaching and learning in each licensure content area. Additional emphasis placed on nurturing a risk-taking classroom community responsive both to high standards of performance and to students with diverse backgrounds, abilities, and learning styles. Prereq: EDJC 186, EDUC 301, EDUC 304, and EDUC 338.

EDJC 405C. Adolescent Education Seminar (3)
Continued study of adolescent development, learner achievement, and assessment. Integrates program learning with student teaching experience. Development of the professional portfolio and preparation for job interviewing. Coreq: EDJC 444C and admission to the professional semester.

EDJC 405D. Multi-Age Education Seminar (3)
Continued study of all grades' development, learner achievement, and assessment. Integrates program learning with student teaching experience. Development of the professional portfolio and preparation for job interviewing. Coreq: EDJC 444D and admission to the professional semester.

EDJC 427. Adolescent Education Special Topics (3)
Practical application of issues to pre-student teaching field setting. Taken by adolescent licensure program students the semester preceding student teaching. Issues of conflict negotiation, social justice, curriculum development and school reform as they relate to the secondary school setting. Prereq: Acceptance into pre-student teaching.

EDJC 444C. Adolescent Student Teaching (9)
A full-day, full-semester of teaching in an accredited secondary school under the direction of a classroom teacher qualified in the content area and a university supervisor. Supervision includes personnel with advanced training in the relevant content area. Lab fee required. Coreq: EDJC 405C and admission to the professional semester.

EDJC 444D. Multi-Age Student Teaching (9)
A full-day, full-semester experience of teaching in an accredited secondary school under the direction of a classroom teacher qualified in the content area and a university supervisor. Supervision includes personnel with advanced training in the relevant content areas. Lab fee required. Coreq: EDJC 405D and admission to the professional semester.

(OHIO TEACHER LICENSURE PROGRAMS)

Teacher Education may be chosen only as a second major by students whose primary major is in a field in which Case has teacher licensure programs approved by the Ohio Department of Education. Ohio teacher licensure can be attained by those undergraduate students who complete the requirements for licensure candidates specified within their content field (primary major) and a second major in Teacher Education, which comprises 35 credit hours in professional education, 12 hours taken at Case and 23 hours taken at John Carroll University.

Adolescence/Young Adult teacher licensure programs are available in integrated language arts (English major), integrated social studies (history major), integrated mathematics (mathematics major), life sciences (biology major), and physical sciences (chemistry or phys-