955.   Field Research Methods
Spring. 4 credits. SOC 312; approval of department.
An overview of the design and execution of social research.

964.   Seminar in Small Group Research
Fall. 4(4-0) Thirty graduate credits including SOC 811, or approval of department.
The experimental and theoretical investigation of organizational processes in small groups.

966.   Social Structure and Personality
Winter. 3 credits. SOC 811 or approval of department.
Theoretical and research problems in analysis of influence of social positions on personality, and influence of personality and social factors in allocating persons to different social positions. Stress will be placed upon quantitative research and contemporary theories of social structure and personality.

967.   Introduction to Formal Theory in Sociology
Spring. 4(4-0) STT 422, a course in research methods.
Analysis of the structure of formal theory in sociology and of the problems of interpretation and verification of deterministic and probalistic theories. Examination of specific practices of theory construction.

968.   Symbolic Interactionism: Theory and Research
Spring. 4(4-0) SOC 811; social psychology concentration.
Theoretical and research problems within the framework of symbolic interaction. The socialization process and the development, maintenance, and enhancement of the self. Critique of the literature and proposals for new research directions.

970.   Theories of Conflict and Change
Fall. 3(3-0) Approval of department.
Major theoretical European and American contributions to the study of conflict and change.

971.   Race, Politics, and Social Structure
Winter. 3(3-0) Approval of department.
Racism, including the social mechanisms by which it is created, maintained, and lessened, and the variant forms of political action related to racism and social structure.

972.   War and International Conflict
Spring. 3(3-0) Approval of department.
Causes, structure and patterns of wars between societies, revolutions within societies and the relation of war and revolution to cross-cultural conflict and change.

973.   Values, Crises and Utopias in a Post-Modern Society
Fall. 3(3-0) Approval of department.
Macro-sociological approach to study of social problems and stresses; planned change; and conscious improvement of modern societies.

976.   Theoretical Perspectives in Sociology
Winter. 4 credits. SOC 845 or SOC 846.
Comparison and analyses of concepts, conceptual schemes and theories of outstanding social theorists in relation to modern research.

977.   Seminar in Selected Theoretical Issues
Spring of odd-numbered years. 4(4-0) May reenroll for a maximum of 8 credits. SOC 845.
Issue approach to social theory. Selected themes relate to substantive problems in theory, theory construction or the work of a historical or contemporary thinker.

978.   Comparative Rural Social Organization
Spring. 4 credits.
Structure and function of social organizations ranging from societies to small groups. The comparative approach will be used in studying phenomena involved in the transitions from agrarian to industrial societies.

981.   Comparative Sociology
Fall. 3 or 4 credits. Doctoral student in sociology; completion of core courses.
Macro-sociological studies of societies. The relationship of the whole to the varied parts of societies, the connection between societies, and the patterns of change in different societies. The development of research with respect to the cross-cultural study of social structures, social institutions, and social systems.

982.   Comparative Social Psychology
Winter. 3 or 4 credits. SOC 981.
Social psychological research problems involving a comparative methodology. Social psychological functions of education, mobility, mass media use, etc. Comparative study of the social psychology of modernization.

983.   Comparative Research Methods
Spring. 3 or 4 credits. SOC 981.
Sampling problems, data collection strategies, problems of translation and concept equivalence. Management, analysis and interpretation of cross-cultural data.

991.   Seminar in Work and Organizations
Winter. 4(4-0) May reenroll for a maximum of 8 credits. Thirty graduate credits and approval of instructor.
Selected topics in the sociology of work, occupations, and complex organizations.

999.   Doctoral Dissertation Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

SPANISH

See Romance and Classical Languages.

STATISTICS AND PROBABILITY   STT

College of Natural Science

Introductory courses are further classified as follows:

315, 316—sequence for undergraduate students of Business Administration.

201—survey course.

421, 422, 423—minimal sequence for students planning to use statistical methods in their research.

441, 442, 443—minimal sequence in theory of statistics. Qualified students should take the 861, 862, 863 sequence instead.

861, 862, 863—sequence for students preparing to do advanced work in statistics.

201.   Statistical Methods
Fall, Winter, Spring, Summer. 4(4-0) MTH 108 or MTH 111. Primarily for students in psychology, sociology, anthropology, political science, economics, agriculture, and forestry. Credit may not be earned in more than one of the following: STT 201, STT 315, STT 421.
Descriptive statistics, elementary probability and combinatories. The binomial distribution. Random variables, their expectations and variances. Central Limit Theorem, estimation and inference. Simple tests based on the binomial, normal, t, chi-square and F distributions.

290.   Special Topics in Statistics and Probability
Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 6 credits. MTH 108 or approval of department.

315.   Introduction to Probability
Fall, Winter, Spring, Summer. 4(5-0) MTH 111. Credit may not be earned in more than one of the following: STT 201, STT 315, STT 421.
Set and algebra of sets. Chance experiments, outcomes and events. Probabilities of events. Conditional probability, independent trials, Bayes' theorem. Introduction to statistical inference relevant to business decision problems.

316.   Fundamentals of Statistical Inference
Fall, Winter, Spring, Summer. 4(5-0) STT 315. Primarily for students in the College of Business. Interdepartmental with the Department of Marketing and Transportation Administration.
Description of sample data, applications of probability theory, sampling, estimation, tests of hypotheses.

317.   Quantitative Business Research Methods
Fall, Winter, Spring, Summer. 4(5-0) STT 315. Interdepartmental with and administered by the Department of Marketing and Transportation Administration.
Application of statistical techniques to business decision making. Topics covered include applications of linear regression and correlation, analysis of variance, selected nonparametric tests, time series, and index numbers.

341.   Probability for Teachers
Spring. 4(4-0) MTH 301 or approval of department.
Primarily for majors in mathematical education. Probability theory will be studied as a mathematical structure. Although some examples of the use of the theory will be discussed (as the use of some theorems is discussed in a course in plane geometry) the major emphasis will be on understanding the structure of probability theory.

351.   Introduction to Statistics
Spring. 4(4-0) MTH 214.
Probability models, discrete random variables, the binomial, hyper-geometric and Poisson distributions, statistical inference based on the binomial distribution, continuous random variables, test of hypothesis and confidence intervals based on the normal distribution.

421.   Statistics I
Fall, Winter, Spring, Summer. 4(4-0) MTH 108. Credit may not be earned in more than one of the following: STT 201, STT 315, STT 421. This course and STT 422, STT 423 form a one year sequence in statistics for those without a calculus background; STT 421 provides an introduction to a few of the main ideas of probability and statistics. The course sequences STT 441-2-3 and STT 861-2-3 form one year sequences in statistics for those with a calculus background. Those expecting to use statistics in their graduate research should complete one of the full year sequences.
Descriptive statistics, elementary probability and combinatorics. The binomial distribution. Random variables, their expectations and variances. The Central Limit theorem, Estimation and inference. Simple tests based on the binomial, normal, t, chi-square and F distributions.

422.   Statistics II
Fall, Winter, Spring, Summer. 3(3-0) STT 421.
Nonparametric models, contingency table analysis, sample survey methods, simple linear regression, one-way analysis of variance.

423.   Statistics III
Fall, Winter, Spring, Summer. 3(3-0) STT 422.
Multiple regression. Anlysis of variance for various experimental designs, including randomized block, two and three way factorial, nested and Latin square designs.

441.   Probability and Statistics I: Probability
Fall, Winter, Spring, Summer. 4(4-0) MTH 215.
Mathematical probability as a basis for the theory of statistics. Discrete and continuous probability models, conditional probability and independence, random variables, central limit theorem, sampling distributions.

442.   Probability and Statistics II: Inference
Winter, Spring. 4(4-0) STT 441; MTH 334 or concurrently.
Estimation, confidence intervals, test of hypotheses, linear hypotheses.

443.   Probability and Statistics III: Inference
Spring. 4(4-0) STT 442.
Multiple linear regression, analysis of variance, goodness of fit tests, certain non-parametric tests.

460.   Theory of Games
Winter of odd-numbered years. 3(3-0) MTH 215, MTH 334.
Zero-sum, two-person games. Extensive and normal forms, convexity, von Nueman minimax theorem and extensions. Methods of solving games. Applications.

490.   Statistical Problems
Fall, Winter, Spring. 1 to 6 credits. Approval of department.
Individualized study adapted to the preparation and interests of the student.

520.   Biostatistical and Epidemiological Reasoning
Winter. 3(3-0) Approval of instructor. Interdepartmental with and administered by the Department of Community Health Science.
Concepts and principles from biostatistics and epidemiology to facilitate critical reading literature relevant to clinical medicine and community health. Emphasis on design and interpretation.

825.   Sample Surveys
Fall. 3(3-0) STT 423 or STT 442 or STT 862.
Application of statistical sampling theory to survey designs involving simple random, stratified, and systematic samples; sub-sampling, double sampling; ratio and regression estimates; other topics.

826.   Nonparametric Statistics
Spring. 4(4-0) STT 442 or STT 862.
Current tests of hypotheses which may be made without specification of the undelying distribution. Rank tests and tests based on permutation of observations. Tolerance and confidence sets. Large-sample distributions. Applications to research in the social and natural sciences.

833.   Mathematical Programming
Spring. 3(3-0) EC 800, or EC 812A, MTH 334. Interdepartmental with the departments of Agricultural Economics, and Economics. Administered by the Department of Agricultural Economics.
Linear programming. Theory of linear economic models. Topics in nonlinear programming.

841.   Linear Statistical Models
Fall of odd-numbered years. 4(4-0) STT 443 or STT 863.
Use of linear statistical models. Curve fitting, simple and multiple regression analysis, multiple and partial correlation coefficients, the analysis of variance, simultaneous confidence intervals, more complex experimental designs.

852.   Methods in Operations Research I
Winter. 3(3-0) STT 441 or STT 861.
Optimization techniques and probability models with a wide variety of applications: linear programming, including special problems; network analysis, including PERT; dynamic programming; game theory; queuing theory. Acquaintance with matrices advisable.

853.   Methods in Operations Research II
Spring. 3(3-0) STT 852.
Continuation of STT 852. Inventory theory; Markov chains with applications; simulation as adjunct to mathematical models; advanced topics in linear programming; non-linear programming.

861.   Theory of Probability and Statistics I
Fall. 4(4-0) MTH 424 or MTH 427 or concurrently.
Discrete probability models. Random variable expectation, combinatorial analysis, conditional probability and independence, generating functions, some special discrete distributions, continuous probability models.

862.   Theory of Probability and Statistics II
Winter. 4(4-0) STT 861; MTH 425 or MTH 428 or concurrently.
Continuous probability models, density transformations, some special continuous distributions, limit laws. Introduction to statistical inference, estimation of parameters, hypothesis testing.

863.   Theory of Probability and Statistics III
Spring. 4(4-0) STT 862; MTH 334, MTH 426 or MTH 429 or concurrently.
Continuation of hypotheses texting, sufficiency, Rao-Blackwellization, some nonparametric methods, linear models.

864.   Stochastic Models in Biology
Fall. 3(3-0) STT 441 or STT 861.
Stochastic processes. Selected topics from growth processes, epidemic theory, prey-predator models, mathematical genetics.

871.   Theory of Probability and Statistics I
Fall. 3(3-0) MTH 823 or STT 863 and MTH 821 or concurrently.
Probability spaces. Distribution functions. Characteristic functions. Law of large numbers, Glivenko-Cantelli theorem, central limit theorem. Some special distributions including multivariate normal. Convergences for sequences of random variables.

872.   Theory of Probability and Statistics II
Winter. 3(3-0) STT 871; MTH 822 or concurrently.
Basic concepts of decision theory. Most powerful tests. Standard statisical methods for use in the binomial, Poisson and normal situation; sequential and nonparametric methods; linear models.

873.   Theory of Probability and Statistics III
Spring. 3(3-0) STT 872; MTH 927 or concurrently; or approval of department.
Asymptotic distributions of some statistics. Cramer-Rao inequality. Asymptotic properties of maximum likelihood methods.

876.   Statistical Inference in Economics I
Fall. 3(3-0) STT 443 or STT 863; EC 812A or EC 801; or approval of department. Interdepartmental with the departments of Agricultutral Economics, and Economics. Administered by the Department of Economics.
Review and extension of single-equation regression models. Properties of least-squares estimators under alternative specifications. Problems of analyzing nonexperimental data. Errors in variable, autoregressive and heteroscedastic models.

877.   Statistical Inference in Economics II
Winter. 3(3-0) EC 876 or approval of department. Interdepartmental with the departments of Agricultural Economics, and Economics. Administered by the Department of Economics.
Specification interpretation and estimation of simultaneous equation models. Nonlinear models. Bayesian approach to estimation problems. Recent developments in econometrics.

878.   Statistical Inference in Economics III
Spring. 3(3-0) EC 877 or approval of department. Interdepartmental with the departments of Agricultural Economics, and Economics. Administered by the Department of Economics.
Validation and application of dynamic econometric models. Bayesian approach to estimation problems. Recent developments in econometric methods and in applied econometric research.

886. **Stochastic Processes and Technological Applications**
Winter. 3(3-0) STT 441 or STT 861.
Discrete stochastic processes. Markov chains, birth and death processes, branching processes. Selected technological applications.

887. **Stochastic Models in the Physical Sciences**
Spring. 3(3-0) STT 886 or approval of department.
Selected models from the physical sciences. These may include topics from the theory of queues, the theory of dams, and branching processes in cosmic ray theory.

890. **Statistical Problems**
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

899. **Master's Thesis Research**
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

927. **Theory of Measure and Integration**
Spring. 3(3-0) MTH 822. Interdepartmental with and administered by the Department of Mathematics.
Introduction to the theory of integration over abstract spaces. Topics include: measure spaces; measurable and integrable functions; modes of convergence, theorems of Egoroff, Lusin, Riesz-Fischer, Lebesgue; absolute continuity, and the Radon-Nikodym theorem; product measures and Fubini's theorem. Applications to some of the classical theories of integration and summability.

928. **Measure Theory Applications to Probability**
Fall. 3(3-0) MTH 927.
Kolmogorov extension theorem. Transition measures. Conditional expectations. Uniform integrability.

929. **Foundations of Decision Theory**
Winter. 3(3-0) STT 928.
Statistical decision model. Principles of choice. Sufficiency, completeness, invariance, monotonicity, Bayes. Families of probability models: exponential, location-scale.

937. **Systems Simulation**
Fall. 4(4-0) MGT 836, STT 423, MTH 228. Interdepartmental with and administered by the Department of Management.
The concept of a model, model building, characteristics of simulation models. Techniques of computer simulation. Simulation models in research and management planning/control. Validation and experimental design. Special purpose languages.

948. **Mathematical Programming For Business**
Spring. 4(4-0) MGT 836, MTH 334, MTH 426, STT 863. Interdepartmental with and administered by the Department of Management.
Large mathematical programs with special structure. Duality and decompostition in mathematical programming. Basic theory of dynamic programming; multistage decision processes and the principle of optimality. Risk, uncertainty, and introduction to stochastic and adaptive control processes.

949. **Advanced Applied Stochastic Processes**
Winter. 4(4-0) MGT 836, MGT 937. Interdepartmental with and administered by the Department of Management.
Selected topics from the following areas: Semi-Markov, Markov-renewal and regenerative process models; Markov and semi-Markov decision processes; decision theory, applications from production, inventory, reliability, queuing, and gaming theory.

951. **Advanced Theory of Nonparametric Statistics**
Fall of odd-numbered years. 3(3-0) STT 873; STT 928 or concurrently.
Possible topics include small and large sample properties of distribution free tests; robust estimation of location, scale and regression parameters; nonparametric ANOVA.

952. **Asymptotic Theory**
Spring of even-numbered years. 3(3-0) STT 873, STT 929.
Possible topics include large sample behavior of likelihood functions; contiguity; Bahadur and Pitman efficiency of statistical procedures.

953. **Advanced Theory of Linear Statistical Models**
Fall of even-numbered years. 3(3-0) STT 873; STT 928 or concurrently.
Possible topics include construction and analysis of linear models; regression; ridge regression; optimality criteria, relationships and merits; existence and construction of optimal designs.

954. **Sequential Analysis**
Spring of odd-numbered years. 3(3-0) STT 873; STT 929.
Possible topics include sequential estimation, testing and design; optimal stopping.

961. **Convergence of Measures and Random Variables**
Fall of odd-numbered years. 3(3-0) STT 873; STT 928, or concurrently.
Topology of vague converence of measures. Conditions for relative compactness of a set of measures. Relationships between vague, almost sure, and in-measure convergence. Donsker's theorem and its extensions; applications to statistics.

962. **Martingales**
Winter or even-numbered years. 3(3-0) STT 873; STT 928.
Convergence, sampling, decomposition and stopping of sub- and super-martingales. Relationship with differentiation of measures. Applications to sequential analysis and boundary crossing probabilities.

963. **Diffusion and Brownian Motion**
Spring of even-numbered years. 3(3-0) STT 873; STT 928.
One dimensional diffusion, speed and drift measures, local time, stochastic integral, Ito's theorem.

964. **Renewal Theory and Random Walk**
Fall of even-numbered years. 3(3-0) STT 873; STT 928 or concurrently.
Renewal events and processes, random walk, Wiener-Hopf factorization, Tauberian theorem. Renewal-Type Equations. Branching processes, birth and death processes.

965. **Second Order Processes**
Winter of odd-numbered years. 3(3-0) STT 873, STT 928.
Stochastic processes studied by the methods of linear spaces. Sample path properties, representatives, estimation, prediction, multiplicity.

966. **Semi-Groups and Applications**
Spring of odd-numbered years. 3(3-0) STT 873, STT 928.
Hille-Yosida theorem, processes of independent increments, infinitely divisible processes, Markov processes in several dimensions.

990. **Problems in Statistics and Probablility**
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 10 credits. STT 873.
Seminar or individual study on an advanced topic in statistics.

995. **Topics in Statistics and Probability**
Fall, Winter, Spring. Variable credit.
Nonparametric statistics, multivariate statistical analysis, statistical time series analysis, Bayesian statistics, reliability theory, stochastic approximation, design of experiments, sets of decision problems, stochastic processes, sequential analysis, other topics.

999. **Doctoral Dissertation Research**
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

STUDIO ART

See Art.

SURGERY   SUR

College of Human Medicine

608. **Surgery Clerkship**
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 43 credits. H M 602.
An introduction to the surgical patient, stressing surgical diagnosis, pre-operative evaluation and post-operative care. Objectives are designed to help the student attain acceptable levels of surgical competence for physicians.

609. **Otolaryngology Clerkship**
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
Common otolaryngologic disorders, emergencies, including diagnosis and treatment, and judgments concerning proper management by primary physicians.

610. **Plastic Clerkship**
Fall, Winter, Spring, Summer. 1 to 17 credits. May reenroll for a maximum of 34 credits. H M 602.
Principles of wound healing and tissue repair. Indications and applications of plastic procedures.