STATISTICS AND PROBABILITY STT

College of Natural Science

Introductory courses are further classified as follows:

315—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 combinatorics. 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. 1 to 6 credits. May reenroll for a maximum of 6 credits. MTH 108 or approval of department.

315. Introduction to Probability and Statistics for Business

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.

Descriptive statistics, elementary probability, random variables, probability models, sampling distributions, the Central Limit Theorem, confidence intervals and one-sample tests based on normal, t and chi-square with applications to business problems.

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.

351. Probability and Statistics for Engineers

Fall, Winter, Spring. 4(4-0) MTH 215.

Discrete and continuous probability models, conditional probability, independence, random variables. Estimation and testing, including one- and two-sample tests and confidence intervals. Applications to engineering problems.

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, combinatorics. Binomial distribution. Random variables, expectations and variances. Central Limit Theorem, point estimation. One sample confidence intervals, tests based on the binomial, normal, t, chi-square distributions.

422. Statistics II

Fall, Winter, Spring, Summer. 3(3-0) STT 421.

Two sample confidence intervals and tests based on the normal and t-distributions. Nonparametric models, contingency table analysis, simple linear regression, one-way analysis of variance.

423. Statistics III

Fall, Winter, Spring. 3(3-0) STT 422.

Multiple regression. Analysis of variance for various experimental designs such as randomized block, 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, tests of hypotheses, linear models.

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.

461. Computations in Statistics and Probability

Spring. 4(4-0) STT 441, MTH 334, one course in computer science or approval of department.

Computer algorithms for evaluation, simulation and visualization: sampling from prescribed distributions; robustness and error analysis of procedures used by statistical packages; graphics for data display; computation of probabilities and percentiles.

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

Fall. 4(4-0) 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 underlying 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.

841. Linear Statistical Models

Fall. 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.

843. Multivariate Analysis

Winter of even-numbered years. 3(3-0) STT 443 or STT 863.

The multivariate normal distribution, tests of hypotheses on means, discriminant analysis, multivariate analysis of variance, principal components, factor analysis, analysis of multivariate categorical data.

844. Time Series Analysis

Winter of odd-numbered years. 3(3-0) STT 443 or STT 863.

The autocorrelation function and its spectrum, moving average and autoregressive processes, model identification and estimation.

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 of even-numbered years. 3(3-0) STT 441 or STT 861.

Stochastic processes. Selected topics from growth processes, epidemic theory, prey-predator models, mathematical genetics.

870. *Theory of Measure and Probability*

Fall. 3(3-0) MTH 821 or concurrently.

Measures and integrals. Uniqueness of extensions. Algebraic and continuity properties. Densities. Fubini theorem. Convergence concepts. Measurable transformations. Independence. Laws of large numbers, characteristic functions, central limit theorem in iid case.

872. *Theory of Statistics I*

Winter. 3(3-0) STT 870; MTH 822 or concurrently.

Important distributions. Order statistics. Slutsky theorem and additional properties of vague convergence. Basic concepts of decision theory. A survey of basic statistical methods.

873. *Theory of Statistics II*

Spring. 3(3-0) STT 872.

Basic concepts and properties of estimation and hypothesis testing. Linear models.

876. *Statistical Inference in Economics I*

Fall. 3(3-0) EC 812A or EC 805A; STT 443 or STT 863; or approval of department. Interdepartmental with the departments of Agricultural 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 variables, 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.

882. *Probability I*

Winter. 3(3-0) STT 870; MTH 822 or concurrently.

Laws of large numbers, random series, central limit problem, stable laws.

883. *Probability II*

Spring. 3(3-0) STT 882.

Extension theorems for integrals including the Kolmogorov theorem. The Radon-Nikodym theorem. Conditional expectations, transitions. Convergence in Lp spaces.

886. *Stochastic Processes and Applications I*

Winter. 3(3-0) STT 441 or STT 861.

Discrete and continuous time Markov processes including the ergodic theorem. Other topics selected from: stationary processes, Brownian motion, stochastic differential equations, Counting and Poisson processes, queuing processes, branching processes.

887. *Stochastic Processes and Applications II*

Spring. 3(3-0) STT 886 or approval of department.

Continuation of STT 886.

890. *Statistical Problems*

Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 36 credits. Approval of department.

899. *Master's Thesis Research*

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

929. *Foundations of Decision Theory*

Fall. 3(3-0) STT 873, STT 883.

Statistical decision model. Principles of choice. Sufficiency, completeness, invariance, monotonicity, Bayes. Families of probability models: exponential, location-scale.

951. *Advanced Theory of Nonparametric Statistics*

Spring of even-numbered years. 3(3-0) STT 929.

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*

Winter of even-numbered years. 3(3-0) STT 929.

Possible topics include large sample behavior of likelihood functions; contiguity; Bahadur and Pitman efficiency of statistical procedures.

954. *Sequential Analysis*

Spring of odd-numbered years. 3(3-0) STT 929.

Possible topics include sequential estimation, testing and design; optimal stopping.

955. *Estimation and Testing*

Winter of odd-numbered years. 3(3-0) STT 929.

Possible topics include completeness and admissibility results for the family of Neyman-Pearson tests, minimum variance estimates, admissibility of estimates in exponential families and estimation in the normal multivariate case.

961. *Convergence of Measures and Random Variables*

Fall of odd-numbered years. 3(3-0) STT 883.

Topology of vague convergence 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 of even-numbered years. 3(3-0) STT 883.

Convergence, sampling, decomposition and stopping of sub- and super-martingales. Relationship with differentiation of measures. Applications to sequential analysis and boundary crossing probabilities.

963. *Stochastic Analysis*

Spring of even-numbered years. 3(3-0) STT 883.

Brownian motion. Stochastic integrals. Ito's formula. Stochastic differential equations. Diffusion processes.

964. *Renewal Theory and Random Walk*

Fall of even-numbered years. 3(3-0) STT 883.

Renewal events and processes, random walk, Wiener-Hopf factorization, Tauberian theorem. Renewal-Type Equations. Branching processes, birth and death processes.

965. *Stationary and Second Order Processes*

Winter of odd-numbered years. 3(3-0) STT 883.

Stationary, second order, and Gaussian processes. Sample path properties. Linear and nonlinear prediction and estimation. Applications.

966. *Markov Processes*

Spring of odd-numbered years. 3(3-0) STT 883.

Transition functions, semigroups, generators. Sample path properties. Strong Markov property. Characterization and convergence of Markov processes. Ergodicity.

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. 1 to 4 credits. May reenroll for a maximum of 36 credits.

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.