SOUTH ASIAN LANGUAGES
See Linguistics and Oriental and African Languages.

SPANISH
See Romance Languages.

STATISTICS AND PROBABILITY

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.

881, 882, 883—sequence in analytic probability theory and stochastic processes at graduate mathematics level.

201. Statistical Methods
Fall, Winter, Spring, Summer. 4(4-0) MTH 105 or 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: 201, 315, 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.

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: 201, 315, 421.


316. Fundamentals of Statistical Inference
Fall, Winter, Spring. 4(5-0) MTH 105 or 111. Primarily for students in the College of Business. Interdepartmental with the Marketing and Transportation Administration Department.

Description of sample data, applications of probability theory, sampling, estimation, tests of hypothesis.

317. Quantitative Business Research Methods
Fall, Winter, Spring. 4(3-2) Interdepartmental with and administered by the Marketing and Transportation Administration Department.

Application of statistical techniques to business decision-making. Topics covered include applications of linear regression and correlation, analysis of variance, selected non-parametric 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 in the use of some theorem 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 105. Credit may not be earned in more than one of the following: 201, 315, 421.

This course and 422, 423 form a one year sequence in statistics for those without a calculus background. 421 provides an introduction to the main ideas of probability and statistics. The course sequences 441, 2-2, and 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. 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. 3(3-0)

Nonparametric tests: sign test, Wilcoxon's rank sum test, Spearman's rank correlation test, run tests. Multiple regression analysis. Least squares estimation and tests for simple linear hypotheses.

423. Statistics III
Fall, Winter, Spring. 3(3-0)

Application of multiple regression analysis to analysis of variance problems. Design of experiments including randomized block designs, Latin squares, factorial designs, and balanced incomplete block 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) 441; MTH 334 or concurrently.

Estimation, confidence intervals, test of hypotheses, linear hypotheses.

443. Probability and Statistics III: Inference
Fall, Spring. 4(4-0) 442.

Multiple linear regression, analysis of variance, goodness of fit tests, certain non-parametric tests.

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

825. Sample Surveys
Fall. 3(3-0) 423 or 442 or 664.

Application of statistical sampling theory to survey design including simple random, stratified, and systematic samples; sub-sampling, double sampling, ratio and regression estimates; other topics.

826. Nonparametric Statistics
Spring. 4(4-0) 442 or 664.

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.

833. Mathematical Programming
Spring. 3(3-0) EC 800, or 8124, 442. Interdepartmental with the Agricultural Economics and Economics Departments and administered by the Agricultural Economics Department.

Linear programming. Theory of linear economic models. Topics in nonlinear programming.

841. Linear Statistical Models
Fall. 4(4-0) 442 or 664.

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) 441 or 861.

Optimization techniques and probability models with a wide variety of applications: linear programming, including special problems; network analysis, including FERT; dynamic programming; game theory; queuing theory. Acquaintance with matrices advisable.

853. Methods in Operations Research II
Spring. 3(3-0) 552.

Continuation of 852. Inventory theory; Markov chains with applications; simulation as an adjunct to mathematical models; advanced topics in linear programming; non-linear programming.

861. Theory of Probability and Statistics I
Fall. 4(4-0) MTH 494 or 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) 861; MTH 425 or 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) 862; MTH 334, 496 or 429 or concurrently.
Continuation of hypotheses testing, sufficiency, Rao-Blackwellization, some non-parametric methods, linear models.

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

865. Theory of Experimental Designs
Fall. 4(4-0) 880 and MTH 831 or approval of department.
Experiments: Cochran's theorem; review of sampling theory; simple designs and statistical analysis; factorial designs and confounding and the group theoretical aspects of these designs; methods, linear models. Rao-Blackwellization, 864. Stochastic Models in Biology. Approval of department.

866. Continuation of hypotheses testing, the group theoretic aspects of these designs; methods, linear models.

871. Statistical Decision Theory I
Fall. 4(4-0) 875; MTH 821 or concurrently.
The general statistical decision problem. Concepts of loss function, risk, admissibility, completeness, minimax and Bayes procedures and reductions due to sufficiency and invariance. The minimax and complete class theorems. Some distributions and sufficient statistics.

872. Statistical Decision Theory II
Winter. 4(4-0) 871; MTH 822 or concurrently.
Exponential families, complete sufficient statistics. Invariant statistical decision problems. Invariant statistical decision problems.

873. Statistical Decision Theory III
Spring. 4(4-0) 875; MTH 927 or concurrently; or approval of department.
Continuation of hypotheses testing, the two sample problem, confidence sets, and the general linear hypothesis. Multiple decision problems.

874. Statistical Inference in Economics I
Fall. 3(3-0) 443 or 863; EC 812A or 803; or approval of department. Interdepartmental with the Agricultural Economics and the Economics Departments and administered by the Economics Department.

875. Statistical Inference in Economics II
Winter. 3(3-0) EC 876 or approval of department. Interdepartmental with the Agricultural Economics and Economics Departments and administered by the Economics Department.

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

881. Probability and Stochastic Processes I
Fall. 3(3-0) MTH 821 or concurrently.
Discrete probability models, dependence and independence, random variables and expectation. Exponential and uniform densities. Special densities and mixtures. Multivariate densities. Probability distributions in R².

882. Probability and Stochastic Processes II
Winter. 3(3-0) MTH 822 or concurrently.

883. Probability and Stochastic Processes III
Spring. 3(3-0) MTH 823 or concurrently.

884. Stochastic Processes and Technological Applications
Winter. 3(3-0) 441 or 861.

885. Stochastic Models in the Physical Sciences
Spring. 3(3-0) 893 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.

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

971. Advanced Theory of Statistics I
Fall. 4(4-0) 873; 891 or concurrently.
Continuation of 873; more general treatment of topics using measure theory and measure-theoretic probability.

972. Advanced Theory of Statistics II
Winter. 4(4-0) 971; 892 or concurrently.

973. Advanced Theory of Statistics III
Spring. 4(4-0) 972.
Continuation of 972.

981. Advanced Theory of Probability I
Fall. 4(4-0) 893; MTH 927 or approval of department.

982. Advanced Theory of Probability II
Winter. 4(4-0) 981 or approval of department.

983. Advanced Theory of Probability III
Spring. 4(4-0) 982 or approval of department.

995. Advanced Topics in Statistics
Fall, Winter, Spring. Variable credit.

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

STUDIO ART
See Art.