Statistics is the science of learning from data. It is concerned with the development of theory and with the application of that theory to the collection, analysis and interpretation of quantitative information.

Because statistics is important in many scholarly disciplines, a degree in statistics provides the opportunity to enter not only the statistics profession but also many other fields which make extensive use of statistics. The areas of application include agriculture, the biological sciences, engineering, the physical sciences, the social sciences, education, business and home economics, among others. Statistics also promises to be important in emerging endeavors such as pollution and environmental research, energy utilization and health-care administration.

Those who pursue the study of statistics should be interested in scientific inquiry and should have a good mathematical background. In addition it is desirable that they have a genuine interest in some other subject which uses statistics.

Careers in government, industry and education, involving the disciplines previously mentioned, are open to the statistics graduate. In government and industry a statistician usually serves as a researcher or as a consultant to research scientists and decision-makers. In education, of course, the teaching function is added to those of research and consultation. In almost all careers, the statistician uses the computer.

The Statistical Laboratory operates within the department to provide statistical consulting to researchers—both faculty and student—across the campus.

The Department of Statistics offers the BS and MS degrees to those interested in applications of statistics, and the PhD degree to those who wish to make original contributions to the theory of statistics.

Courses

STAT 2013 Elementary Statistics (A)
Prerequisites: MATH 1483 or MATH 1513, each with a grade of "C" or better; or an acceptable placement score (see placement.okstate.edu).
Description: An introductory course in the theory and methods of statistics. Descriptive measures, elementary probability, samplings, estimation, hypothesis testing, correlation and regression. No degree credit for students with credit in STAT 2023 or STAT 2053.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Statistics
General Education and other Course Attributes: Analytical & Quant Thought

STAT 2023 Elementary Statistics for Business and Economics (A)
Prerequisites: MATH 1483 or MATH 1513, each with a grade of "C" or better; or an acceptable placement score (see placement.okstate.edu).
Description: Basic statistics course for undergraduate business majors. Descriptive statistics, basic probability, discrete and continuous distributions, point and interval estimation, hypothesis testing, correlation and simple linear regression. No degree credit for students with credit in STAT 2013 or STAT 2053.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Statistics
General Education and other Course Attributes: Analytical & Quant Thought

STAT 2053 Elementary Statistics for the Social Sciences (A)
Prerequisites: MATH 1483 or MATH 1513, each with a grade of "C" or better; or an acceptable placement score (see placement.okstate.edu).
Description: No credit for business majors. An introductory course in the theory and methods of statistics. Descriptive measures, elementary probability, sampling, estimation, hypothesis testing, correlation and regression. No degree credit for students with credit in STAT 2013 or 2023.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Statistics
General Education and other Course Attributes: Analytical & Quant Thought

STAT 2331 SAS Programming
Prerequisites: A different programming language or consent of instructor.
Description: SAS as a general purpose programming language, data representation, input/output, use of built-in procedures, report generation. Course previously offered as CS 2331.
Credit hours: 1
Contact hours: Lecture: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Statistics

STAT 2890 Honors Experience in Statistics
Prerequisites: Honors Program participation and concurrent enrollment in a designated STAT course.
Description: A supplemental Honors experience in statistics to partner concurrently with designated statistics courses. This course adds a different intellectual dimension to the designated courses.
Credit hours: 1
Contact hours: Lecture: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Statistics
General Education and other Course Attributes: Honors Credit
STAT 3013 Intermediate Statistical Analysis  
Prerequisites: STAT 2013, STAT 2023 or STAT 2053.  
Description: Applications of elementary statistics, introductory experimental design, introduction to the analysis of variance, simple and multiple linear regression, nonparametric statistics, survey sampling and time series. Data analysis using Excel included.  
Credit hours: 3  
Contact hours: Lecture: 3  
Levels: Undergraduate  
Schedule types: Lecture  
Department/School: Statistics  

STAT 4013 Statistical Methods I (A)  
Prerequisites: MATH 1513 with a grade of "C" or better; or an acceptable placement score (see placement.okstate.edu).  
Description: Basic experimental statistics, basic probability distributions, methods of estimation, tests of significance, linear regression and correlation, analysis of variance for data that are in a one way, a two-way crossed, or in a two-fold nested classification. May not be used for degree credit with STAT 4053.  
Credit hours: 3  
Contact hours: Lecture: 3  
Levels: Undergraduate  
Schedule types: Lecture  
Department/School: Statistics  

General Education and other Course Attributes: Analytical & Quant Thought  

STAT 4023 Statistical Methods II (A)  
Prerequisites: STAT 3013 or STAT 4013 or STAT 4033 or STAT 4053.  
Description: Basic concepts of experimental design. Analysis of variance, covariance, split-plot design. Factorial arrangements of treatments, multiple and curvilinear regression, enumeration data. No degree credit for students with credit in STAT 4063.  
Credit hours: 3  
Contact hours: Lecture: 3  
Levels: Undergraduate  
Schedule types: Lecture  
Department/School: Statistics  

STAT 4033 Engineering Statistics  
Prerequisites: MATH 2163 or MATH 2163.  
Description: Probability, random variables, probability distributions, estimation, confidence intervals, hypothesis testing, basic analysis of variance, factorial arrangement of treatments and fractional factorial experiments, elementary quality control. No degree credit for students with credit in STAT 4033.  
Credit hours: 3  
Contact hours: Lecture: 3  
Levels: Undergraduate  
Schedule types: Lecture  
Department/School: Statistics  

STAT 4073 Engineering Statistics with Design of Experiments  
Prerequisites: MATH 2163.  
Description: Random variables and basic probability distributions, estimation, confidence intervals, hypothesis testing, basic analysis of variance, factorial arrangement of treatments and fractional factorial experiments, elementary quality control. No degree credit for students with credit in STAT 4033.  
Credit hours: 3  
Contact hours: Lecture: 3  
Levels: Undergraduate  
Schedule types: Lecture  
Department/School: Statistics  

STAT 4091 Sas Programming  
Prerequisites: STA 4013 or equivalent.  
Description: SAS dataset construction, elementary statistical analysis, and use of statistics and graphics procedures available in SAS. No credit for students with credit in 5091.  
Credit hours: 1  
Contact hours: Lecture: 1  
Levels: Undergraduate  
Schedule types: Lecture  
Department/School: Statistics  

STAT 4203 Mathematical Statistics I  
Prerequisites: MATH 2163 with a grade of "C" or better.  
Description: Introduction to probability theory for students who are not graduate majors in statistics or mathematics. Probability, dependence and independence, random variables, univariate distributions, multivariate distributions, moments, functions of random variables, moment generating functions.  
Credit hours: 3  
Contact hours: Lecture: 3  
Levels: Graduate, Undergraduate  
Schedule types: Lecture  
Department/School: Statistics
STAT 4213 Mathematical Statistics II
Prerequisites: STAT 4203 and MATH 3013.
Description: Statistical inference for students who are not graduate majors in statistics or mathematics. Sampling distributions, maximum likelihood methods, point and interval estimation, hypothesis testing.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate, Undergraduate
Schedule types: Lecture
Department/School: Statistics

STAT 4463 Multivariate Methods
Prerequisites: STAT 4043 and (STAT 4023 or STAT 5023).
Description: Use of Hotelling’s T-squared statistic, multivariate analysis of variance, canonical correlation, principal components, factor analysis and linear discriminate functions. No credit for students with credit in STAT 5063.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Statistics

STAT 4910 Special Studies
Prerequisites: Consent of instructor.
Description: Special subjects in statistics. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Other: 1
Levels: Graduate, Undergraduate
Schedule types: Independent Study
Department/School: Statistics

STAT 4981 Statistics Capstone I
Prerequisites: STAT 4023, STAT 4043, STAT 4091 and STAT 4203 or concurrent enrollment.
Description: Information and preparation for graduate school for statistics undergraduates, communication skills for collaborating with scientists, introduction to research in statistics.
Credit hours: 1
Contact hours: Lecture: 1
Levels: Undergraduate
Schedule types: Lecture
Department/School: Statistics

STAT 4993 Senior Honors Project
Prerequisites: Departmental invitation, senior standing, Honors Program participation.
Description: A guided reading and research program ending with an honors project under the direction of a faculty member, with a second faculty reader and an oral examination. Required for graduation with departmental honors in statistics.
Credit hours: 3
Contact hours: Other: 3
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Statistics
General Education and other Course Attributes: Honors Credit

STAT 5000 Master's Research
Prerequisites: Consent of advisory committee.
Description: Methods of research and supervised thesis or report. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Statistics

STAT 5002 Applied Masters Creative Component
Prerequisites: Consent of advisory committee.
Description: Creative component for Applied Masters in Statistics.
Credit hours: 2
Contact hours: Other: 2
Levels: Graduate
Schedule types: Independent Study
Department/School: Statistics

STAT 5003 Statistics for Medical Residents
Prerequisites: Employed as a medical or veterinary resident or permission of instructor.
Description: Survey of statistical methodology relevant to health care professionals. Basic understanding of statistics presented in recent medical literature. Hypothesis testing, ANOVA techniques, regression, categorical techniques. Same course as BIOM 5003.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5013 Statistics for Experimenters I
Prerequisites: Graduate standing and MATH 1513.
Description: Introductory statistics course for graduate students. Descriptive statistics, basic probability, estimation, hypothesis testing, p-values, analysis of variance, multiple comparisons, correlation and linear regression, categorical data analysis.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics
STAT 5023 Statistics for Experimenters II
Prerequisites: Graduate standing and STAT 4023 or STAT 5013.
Description: Analysis of variance, contrasts and multiple comparisons, factorial experiments, variance components and their estimation, completely randomized, randomized block and Latin square designs, split plot experiments.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5033 Nonparametric Methods
Prerequisites: One of STAT 4023, STAT 4043, STAT 5023 or consent of instructor.
Description: A continuation of STAT 4013 and STAT 4023, concentration on nonparametric methods. Alternatives to normal-theory statistical methods; analysis of categorical and ordinal data, methods based on rank transforms, measures of association, goodness of fit tests, order statistics.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5043 Sample Survey Designs
Prerequisites: One of STAT 4013, STAT 4033, STAT 5013 or consent of instructor.
Description: Constructing and analyzing personal, telephone and mail surveys. Descriptive surveys including simple random, stratified random designs. Questionnaire design, frame construction, non-sampling errors, use of random number tables, sample size estimation and other topics related to practical conduct of surveys.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5053 Time Series Analysis
Prerequisites: STAT 4043.
Description: An applied approach to the analysis of time series in the time domain. Trends, autocorrelation, random walk, seasonality, stationarity, autoregressive integrated moving average (ARIMA) processes, Box-Jenkins method, forecasting.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5063 Multivariate Methods
Prerequisites: STAT 4043 and (STAT 4023 or STAT 5023).
Description: Use of Hotelling’s T-squared statistic, multivariate analysis of variance, canonical correlation, principal components, factor analysis and linear discriminate functions. No degree credit for students with credit in STAT 4463.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5073 Categorical Data Analysis
Prerequisites: STAT 5223, STAT 5023 or equivalent or concurrent enrollment
Description: Analysis of data involving variables of a categorical nature. Contingency tables, exact tests, binary response models, loglinear models, analyses involving ordinal variables, multinomial response models. Computer usage for analysis is discussed.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5083 Statistics for Biomedical Researchers
Prerequisites: STAT 5013.
Description: Analysis of variance, experimental designs pertaining to medical research, regression and data modeling, categorical techniques and the evaluation of diagnostic tests. No credit for students with credit in STAT 5023.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5091 Sas Programming
Prerequisites: STAT 5013 or equivalent.
Description: SAS dataset construction, elementary statistical analysis, and use of statistics and graphics procedures available in SAS. No credit for students with credit in 4091.
Credit hours: 1
Contact hours: Lecture: 1
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5093 Statistical Computing
Prerequisites: STAT 5123 or STAT 4203, STAT 5013 or equivalent, CS 1113 or equivalent.
Description: Random variable generation; numerical calculations of maximum likelihood estimators, quasi-likelihood estimators, probabilities, and quantiles; computer intensive exact tests and distributions; randomized tests; bootstrap and jack knife methods, Monte Carlo simulations Markov Chain Monte Carlo methods for Bayesian estimation.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5123 Probability Theory
Prerequisites: MATH 2163 and one other course in MATH that has either MATH 2144 or MATH 2153 as a prerequisite.
Description: Basic probability theory, random events, dependence and independence, random variables, moments, distributions of functions of random variables, weak laws of large numbers, central limit theorems.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics
STAT 5133 Stochastic Processes
Prerequisites: STAT 5123 and MATH 2233, MATH 3013.
Description: Definition of a stochastic process, probability structure, mean and covariance function, the set of sample functions, stationary processes and their spectral analyses, renewal processes, counting processes, discrete and continuous Markov chains, birth and death processes, exponential model, queuing theory. Same course as IEM 5133 & MATH 5133.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5213 Bayesian Analysis
Prerequisites: STAT 5223 or consent of instructor.
Description: Fundamentals of Bayesian inference, Bayesian hierarchical models, choices of priors, Markov chain Monte Carlo, model checking and comparison, advanced topics and applications.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5223 Statistical Inference
Prerequisites: STAT 5123 and MATH 3013.
Description: Sampling distributions, point estimation, maximum likelihood methods, Rao-Cramer inequality, confidence intervals, hypothesis testing, sufficiency, completeness. Previously offered as STAT 4223.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5303 Experimental Designs
Prerequisites: STAT 5023 or STAT 4023 with consent of instructor.
Description: Review of basic concepts, interpretation of main effects and interactions in multi-factor designs, multiple comparisons, split-unit experiments, complete and incomplete block designs, linear mixed models analysis (including repeated measures analysis), $2^n$ and $3^n$ factorial experiments, fractional factorial experiments, crossover designs.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5323 Theory of Linear Models I
Prerequisites: STAT 5223, MATH 3013, and one of STAT 4023 or STAT 5023.
Description: Matrix theory (generalized inverse, idempotent matrix, and non-negative matrix results), multivariate normal distribution, quadratic forms, chi-square distribution, general linear models, estimability, general hypothesis testing.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5333 Theory of Linear Models II
Prerequisites: STAT 5323
Description: Maximum likelihood estimation; one- way and two-way ANOVA models, multiple comparisons, regression models, linear mixed models, variance component estimation.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5513 Multivariate Analysis
Prerequisites: STAT 5323.
Description: Multivariate normal distribution, simple, partial and multiple correlation, multivariate sampling distributions. Wishart distribution, general T-distribution, estimation of parameters and tests of hypotheses on vector means and covariance matrix. Classification problems, discriminate analysis, and applications.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 5910 Seminar in Statistics
Prerequisites: Consent of instructor.
Description: Investigation of special problems in the theory and/or application of statistics using current techniques. Special studies for M.S. level students. Offered for variable credit, 1-6 credits. Maximum of 3 credit hours.
Credit hours: 1-6
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Statistics

STAT 6000 Doctoral Dissertation
Prerequisites: Consent of advisory committee.
Description: Directed research culminating in the PhD thesis. Offered for variable credit, 1-10 credit hours, maximum of 30 credit hours.
Credit hours: 1-10
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Statistics

STAT 6010 Statistics Literature
Prerequisites: Consent of instructor.
Description: Published journal articles from statistics or related areas are discussed. Previously offered as STAT 6001.
Credit hours: 1
Contact hours: Lecture: 1
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics
STAT 6013 Genetic Statistics
Prerequisites: A one-year graduate level sequence in statistics or with the permission of the instructor.
Description: Course provides a statistical basis for modeling genetic evolution in populations and describing variation in quantitative traits. Population genetics principles will be used to study DNA sequence variation and quantitative traits.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 6113 Probability Theory
Prerequisites: STAT 5123 and MATH 5143.
Description: Measure theoretical presentation of probability, integration and expectation, product spaces and independence, conditioning, different kinds of convergence in probability theory, statistical spaces, characteristic functions and their applications. Previously offered as STAT 5113.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 6203 Large Sample Inference
Prerequisites: STAT 5223 and MATH 5143.
Description: Different types of convergence in probability theory, central limit theorem, consistency, large sample estimation and tests of hypotheses, concepts of asymptotic efficiency, nonparametric tests. Previously offered as STAT 5203.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 6223 Advanced Statistical Inference
Prerequisites: STAT 6113.
Description: Point estimation, maximum likelihood, Cramer-Rao inequality, confidence intervals, Neyman-Pearson theory of testing hypothesis and power of test. Previously offered as STAT 6213.
Credit hours: 3
Contact hours: Lecture: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Statistics

STAT 6910 Special Problems
Prerequisites: Consent of instructor.
Description: Investigation of special problems in the theory and application of statistics using current techniques. Special studies for PhD level students. Offered for variable credit, 1-6 credit hours, maximum of 12 credit hours.
Credit hours: 1-6
Contact hours: Other: 1
Levels: Graduate
Schedule types: Independent Study
Department/School: Statistics

Undergraduate Programs
Admission Requirements
It is necessary to have an undergraduate degree, not necessarily in statistics or mathematics, to begin a program of study toward the master's degree in statistics. In some instances, it may be advantageous to have an undergraduate degree in another field. However, the student should have acquired a good mathematical background as an undergraduate. This should be equivalent to the required mathematics courses in the bachelor's program:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2144</td>
<td>Calculus I (A)</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2153</td>
<td>Calculus II (A)</td>
<td>3</td>
</tr>
<tr>
<td>MATH 2163</td>
<td>Calculus III</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3013</td>
<td>Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4013</td>
<td>Calculus of Several Variables</td>
<td>3</td>
</tr>
</tbody>
</table>

Students admitted to the program with deficiencies will be required to remedy such deficiencies.

The Master of Science Degree
The Master of Science degree in statistics is designed to prepare students for work as a statistician or doctoral studies in statistics. It may be completed by following one of the three plans listed in the "Graduate College (http://catalog.okstate.edu/graduate-college)" section of the Catalog. Normally, the all-course work plan will be initiated at the suggestion of the faculty. Each student will be required to attain an introductory knowledge of some field of application outside of statistics, mathematics and computer science. This requirement may be satisfied by having taken a three-hour graduate course in an approved field of statistical application. Each student is required to have demonstrated competence in a procedure-oriented language such as FORTRAN.

The Master of Science in Applied Statistics Degree
The Master of Science in Applied Statistics (MSAS) degree can be completed with online coursework. It is intended to be a terminal professional master's degree. It is not intended to be preparation for doctoral work in statistics. Neither comprehensive exams nor a thesis or formal report is required for completion of this degree. A two-hour creative component course is required at the end of the matriculation through the program. More information regarding this degree can be found on the OSU Statistics Department website.

The Doctor of Philosophy Degree
The PhD requires the completion of 90 hours beyond the BS degree. A maximum of 30 of these credit hours may be earned by research for the dissertation. Each student will be required to attain an introductory knowledge of some field of application which may be satisfied by taking two three-hour graduate courses outside the fields of statistics, mathematics and computing. Each student is required to have completed
CS 1113 Computer Science I (A) or to have demonstrated competence in a procedure-oriented language such as FORTRAN.

Faculty
Mark E. Payton, PhD—Regents Service Professor and Head
Professors: Ibrahim A. Ahmad, PhD (emeritus); P. Larry Claypool, PhD (emeritus); J. Leroy Folks, PhD (emeritus); Melinda H. McCann, PhD
Associate Professors: Carla L. Goad, PhD; Joshua Habiger, PhD; Brenda J. Masters, PhD; Lan Zhu, PhD
Assistant Professors: Ye Liang, PhD; R. Adam Molnar, PhD