Statistics

Statistics is one of the natural, mathematical, and biomedical sciences programs in the Columbian College of Arts and Sciences. The curriculum emphasizes the important role of statistics as it provides methodologies for making advances in medicine, genetics, and other research arenas, and for making decisions in business and public policy. The program prompts students to learn the reasoning and methods for analyzing and understanding data as they explore how these skills can be applied to develop new initiatives.

Undergraduate

Bachelor's Program
- Bachelor of Science with a major in statistics (http://bulletin.gwu.edu/arts-sciences/statistics/bs)

Minor
- Minor in statistics (http://bulletin.gwu.edu/arts-sciences/statistics/minor)

Graduate

Master's Programs
- Master of Science in the field of biostatistics (http://bulletin.gwu.edu/public-health/epidemiology-biostatistics/ms-biostatistics) (jointly administered by the Department of Statistics in CCAS and the Department of Epidemiology and Biostatistics in SPH)
- Master of Science in the field of statistics (http://bulletin.gwu.edu/arts-sciences/statistics/ms)

Doctoral Programs
- Doctor of Philosophy in the field of biostatistics (http://bulletin.gwu.edu/public-health/epidemiology-biostatistics/phd-biostatistics) (jointly administered by the Department of Statistics in CCAS and the Department of Epidemiology and Biostatistics in SPH)
- Doctor of Philosophy in the field of statistics (http://bulletin.gwu.edu/arts-sciences/statistics/phd)

Certificate
- Graduate certificate in survey design and data analysis (http://bulletin.gwu.edu/arts-sciences/statistics/certificate-survey-design-data-analysis)

Faculty


Associate Professors: S. Bose, S. Kundu, Y. Lai, M. Larsen, J.R. Stroud

Assistant Professors: T. Apanasovich, S. Balaji, W. Barta, J. Landon, Q. Pan

Professorial Lecturers: P. Chandhok, C.M. Fleming, F. Ponti

Courses

Explanations of Course Numbers
- Courses in the 1000s are primarily introductory undergraduate courses
- Those in the 2000-4000s are upper-division undergraduate courses that can also be taken for graduate credit with permission and additional work
- Those in the 6000s and 8000s are for master’s, doctoral, and professional-level students
- The 6000s are open to advanced undergraduate students with approval of the instructor and the dean or advising office

Note: STAT 1051 Introduction to Business and Economic Statistics, STAT 1053 Introduction to Statistics in Social Science, STAT 1111 Business and Economic Statistics I, and STAT 1127 Statistics for the Biological Sciences are related in their subject matter, and credit for only one of these courses may be applied toward a degree. One entrance unit in algebra is prerequisite to all courses in statistics.

STAT 1000. Dean's Seminar. 3 Credits.
The Dean's Seminars provide Columbian College first-year students focused scholarship on specific intellectual challenges. Topics vary by semester. See the Schedule of Classes for more details. Restricted to First-year students in CCAS.

STAT 1051. Introduction to Business and Economic Statistics. 3 Credits.
Lecture (3 hours), laboratory (1 hour). Frequency distributions, descriptive measures, probability, probability distributions, sampling, estimation, tests of hypotheses, regression and correlation, with applications to business.

STAT 1053. Introduction to Statistics in Social Science. 3 Credits.
Lecture (3 hours), laboratory (1 hour). Frequency distributions, descriptive measures, probability, sampling, estimation, tests of hypotheses, regression and correlation, with applications to social sciences.

STAT 1091. Principles-Statistical Methods. 3 Credits.

STAT 1111. Business and Economic Statistics I. 3 Credits.
Descriptive statistics, graphical methods, probability, special distributions, random variables, sampling, estimation and confidence intervals, hypothesis testing, correlation and regression.
STAT 1127. Statistics for the Biological Sciences. 3 Credits.
Introduction to statistical techniques and reasoning applicable to the biomedical and related sciences. Properties of basic probability functions: binomial, Poisson, and normal. Data analysis, inference, and experimental design.

STAT 1129. Introduction to Computing. 3 Credits.
Introduction to elements of computer programming and problem-solving using Pascal. Hands-on experience will be acquired through computer programming projects, including some simple statistical applications.

STAT 2105. Statistics in the Behavioral Sciences. 3 Credits.
Lecture (3 hours), laboratory (1 hour). Advanced study of statistical techniques for research problems. Analysis of variance, correlation techniques, nonparametric techniques, sampling theory. Prerequisite: an introductory statistics course and satisfactory performance on a placement examination.

STAT 2112. Business and Economic Statistics II. 3 Credits.
Continuation of Stat 1111, with emphasis on techniques of regression, chi-square, nonparametric inference, index numbers, time series, decision analysis, and other topics used in economics and business. Prerequisite: STAT 1111.

STAT 2118. Regression Analysis. 3 Credits.
Lecture (3 hours), laboratory (1 hour). Simple and multiple linear regression, partial correlation, residual analysis, stepwise model building, multicollinearity and diagnostic methods, indicator variables. Prerequisites: STAT 1111 or equivalent.

STAT 2123. Introduction to Econometrics. 3 Credits.
Same as Econ 2123.

STAT 2183. Intermediate Stat Lab/Packages. 3 Credits.
Application of program packages (e.g., SAS, SPSS) to the solution of one-, two- and k-sample parametric and nonparametric statistical problems. Basic concepts in data preparation, modification, analysis and interpretation of results. Prerequisite: an introductory statistics course.

STAT 2183W. Intermediate Statistical Laboratory: Statistical Computing Packages. 3 Credits.
Application of program packages (e.g., SAS, SPSS) to the solution of one-, two- and k-sample parametric and nonparametric statistical problems. Basic concepts in data preparation, modification, analysis and interpretation of results. Prerequisite: an introductory statistics course.

STAT 3119. Analysis of Variance. 3 Credits.
Lecture (3 hours), laboratory (1 hour). Introduction to the design of experiments and analysis of variance; randomized block, factorial, Latin square designs, and analysis of covariance. Prerequisite: STAT 2118.

STAT 3187. Introduction to Sampling. 3 Credits.
Problems of sampling and sample design. Simple random, stratified, systematic, cluster, and multistate designs; control of sampling and non-sampling errors. Prerequisite: STAT 1051.

STAT 4157. Introduction to Mathematical Statistics I. 3 Credits.
Basic concepts of probability theory, including random variables, independence, distribution theory, and sampling theory. Prerequisite: MATH 1232.

STAT 4158. Introduction to Mathematical Statistics II. 3 Credits.
Continuation of STAT 4157. Inference procedures, including estimation, hypothesis testing, regression analysis, and experimental design. Prerequisite: MATH 1232.

STAT 4181. Applied Time Series Analysis. 3 Credits.
Autoregressive integrated moving average (ARIMA) modeling and forecasting of univariate time series. Estimation of spectral density functions, white noise tests, and tests for periodicities. Theory and applications using SAS. Prerequisite: MATH 2233, STAT 4157–STAT 4158 or STAT 2118.

STAT 4188. Nonparametric Stat Inference. 3 Credits.
Statistical inference when the form of the underlying distribution is not fully specified. Nonparametric procedures for estimation and testing hypotheses. An introduction to robust procedures. Prerequisite: STAT 1051.

STAT 4189. Mathematical Probability and Applications I. 3 Credits.
Probability theory, including combinatorial analysis, conditional probability, and stochastic independence. Random variables and their distributions; laws of large numbers and central limit theorem. Application of concepts to elementary stochastic processes (coin-tossing sequences, branching processes, Markov chains). Prerequisite: MATH 1232.

STAT 4190. Mathematical Probability and Applications II. 3 Credits.
Continuation of STAT 4189. Probability theory, including combinatorial analysis, conditional probability, and stochastic independence. Random variables and their distributions; laws of large numbers and central limit theorem. Application of concepts to elementary stochastic processes (coin-tossing sequences, branching processes, Markov chains). Prerequisite: MATH 1232.

STAT 4195. Reading and Research. 1-12 Credits.
May be repeated once for credit. Admission by permission of department chair.

STAT 4197. Fundamentals of SAS Programming for Data Management. 3 Credits.
Fundamentals of the SAS system for data management, statistical analysis, and report writing. Data modification; programming; file handling; and macro writing. Prerequisite: An introductory statistics course and STAT 1129.

STAT 4198. Special Topics. 3 Credits.
Topic to be announced in the Schedule of Classes. May be repeated for credit provided the content differs.
STAT 6104. Statistics in Management, Administration, and Policy Studies. 3 Credits.
Introductory study of statistical techniques for research problems. For graduate students in fields other than statistics who have no previous statistics training. May not be taken by graduate students in statistics.

STAT 6201. Mathematical Statistics I. 3 Credits.
Probability, distribution theory, sampling theory, estimation, sufficient statistics, hypothesis testing, analysis of variance, multivariate normal distribution. Prerequisite: MATH 2233, MATH 2184.

STAT 6202. Mathematical Statistics II. 3 Credits.
Continuation of STAT 6201. Probability, distribution theory, sampling theory, estimation, sufficient statistics, hypothesis testing, analysis of variance, multivariate normal distribution. Prerequisite: MATH 2233, MATH 2184.

STAT 6207. Methods of Statistical Computing I. 3 Credits.
Error analysis, computational aspects of linear models, sweep operator, random number generation, simulation, resampling. Optimization, numerical integration (Gaussian quadrature, Simpson’s rule); E-M algorithm. Prerequisite: STAT 2118, STAT 4157– STAT 4158; MATH 2184; knowledge of a programming language.

STAT 6208. Methods of Statistical Computing II. 3 Credits.

STAT 6210. Data Analysis. 3 Credits.
Review of statistical principles of data analysis, using computerized statistical procedures. Multiple regression and the general linear model, analysis of contingency tables and categorical data, logistic regression for qualitative responses. Prerequisite: STAT 2118, STAT 4157 or STAT 6201, and STAT 2183.

STAT 6213. Intermediate Probability and Stochastic Processes. 3 Credits.
Discrete and continuous random variables and their distributions, conditional distributions and conditional expectation, generating functions and their applications, convergence of random variables; introduction to Brownian motion, homogeneous and nonhomogeneous Poisson processes and martingales. Prerequisite: STAT 6201- STAT 6202.

STAT 6214. Applied Linear Models. 3 Credits.
Introduction to regression techniques for discrete and continuous response variables. The course includes a computing component using SAS and S> Prerequisite: MATH 2233 and MATH 2184.

STAT 6215. Applied Multivariate Analysis I. 3 Credits.
Application of multivariate statistical techniques to multidimensional research data from the behavioral, social, biological, medical, and physical sciences. Prerequisite: STAT 3119, STAT 4157- STAT 4158; MATH 2184.

STAT 6216. Applied Multivariate Analysis II. 3 Credits.
Continuation of STAT 6215. Application of multivariate statistical techniques to multidimensional research data from the behavioral, social, biological, medical, and physical sciences. Prerequisite: STAT 3119, STAT 4157- STAT 4158; MATH 2184.

STAT 6217. Design of Experiments. 3 Credits.
Design and analysis of single- and multiple-factor experiments. Includes block designs, repeated measures, factorial and fractional factorial experiments, response surface experimentation. Prerequisite: STAT 4157-STAT 4158; MATH 2184.

STAT 6218. Linear Models. 3 Credits.
Theory of the general linear parametric model. Includes least squares estimation, multiple comparisons procedures, variance components estimation. Prerequisite: STAT 6201- STAT 6202; MATH 2184.

STAT 6221. Design of Experiments for Behavioral Sciences. 3 Credits.
Applications of advanced experimental design to research problems in behavioral sciences and education. Prerequisite: STAT 2105 or STAT 2118 and permission of instructor. Not open to graduate students in statistics.

STAT 6223. Bayesian Statistics: Theory and Applications. 3 Credits.
An overview of Bayesian statistics, including its foundational issues, decision under uncertainty, linear models, expert opinion, and computational issues. Prerequisite: STAT 6201- STAT 6202.

STAT 6227. Survival Analysis. 3 Credits.
Parametric and nonparametric methods for the analysis of events observed in time (survival data), including Kaplan-Meier estimate of survival functions, logrank and generalized Wilcoxon tests, the Cox proportional hazards model and an introduction to counting processes. Prerequisite: STAT 6201- STAT 6202 or permission of instructor.

STAT 6231. Contingency Table Analysis. 3 Credits.
A study of the theoretical bases underlying the analysis of categorical data. Measures and tests of association; Mantel-Haenszel procedure; weighted least squares and maximum likelihood estimators in linear models; estimating equations; logistic regression; loglinear models. Prerequisite: STAT 6201- STAT 6202.
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<tr>
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<td>STAT 6234</td>
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<td>STAT 6236</td>
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<td>STAT 6238</td>
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<td>STAT 6251</td>
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<td>STAT 6252</td>
<td>Statistical Methods in Bioinformatics and Computational Biology.</td>
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<td>STAT 6282</td>
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<td>STAT 6287</td>
<td>Modern Theory of Sample Surveys.</td>
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<td>STAT 6290</td>
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<td>Seminar: Special Topics.</td>
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STAT 8259. Advanced Probability. 3 Credits.
Conditional expectation and martingales; weak convergence in general metric spaces and functional central limit theorems for i.i.d. random variables and martingales; applications to biostatistics. Prerequisite: STAT 8257 or an equivalent measure-theoretic introduction to probability.

STAT 8262. Nonparametric Inference. 3 Credits.
Inference when the form of the underlying distribution is unspecified. Prerequisite: STAT 6201–STAT 6202.

STAT 8263. Advanced Statistical Theory I. 3 Credits.
Decision theoretic estimation, classical point estimation, hypothesis testing. Prerequisite: STAT 6201–STAT 6202.

STAT 8264. Advanced Statistical Theory II. 3 Credits.
Asymptotic theory, hypothesis testing, confidence regions. Prerequisite: STAT 8257, STAT 8263.

STAT 8265. Multivariate Analysis. 3 Credits.
Multivariate normal distribution. Hotelling’s T2 and generalized T20, Wishart distribution, discrimination and classification. Prerequisite: STAT 6201–STAT 6202.

STAT 8266. Topics-Multivariate Analysis. 3 Credits.

STAT 8271. Foundational and Philosophical Issues in Statistics. 3 Credits.
Axiomatic underpinnings of Bayesian statistics, including subjective probability, belief, utility, decision and games, likelihood principle, and stopping rules. Examples from legal, forensic, biological, and engineering sciences. Students are expected to have a background in computer science, economics, mathematics, or operations research. Prerequisite: STAT 6201–STAT 6202.

STAT 8273. Stochastic Processes I. 3 Credits.
Fundamental notions of Markov chains and processes, generating functions, recurrence, limit theorems, random walks, Poisson processes, birth and death processes, applications. Prerequisite: STAT 6201–STAT 6202.

STAT 8274. Stochastic Processes II. 3 Credits.
Continuation of STAT 8273. Fundamental notions of Markov chains and processes, generating functions, recurrence, limit theorems, random walks, Poisson processes, birth and death processes, applications. Prerequisites: STAT 6201–STAT 6202.

STAT 8281. Advanced Time Series Analysis. 3 Credits.
Autoregressive integrated moving average (ARIMA) modeling and forecasting of univariate and multivariate time series. Statespace or Kalman filter models, spectral analysis of multiple time series. Theory and applications using the University computer. Prerequisite: MATH 2233, STAT 6201–STAT 6202.

STAT 8288. Modern Theory/Sample Surveys. 3 Credits.

STAT 8289. Seminar. 3 Credits.
Admission by permission of instructor.

STAT 8375. Econometrics I. 3 Credits.
Statistical foundations for econometrics; standard methods of estimation and inference for classical and generalized regression models. Same as ECON 8375.

STAT 8376. Econometrics II. 3 Credits.
Topics may include asymptotic theory, statistical endogeneity, instrumental variables estimation, discrete and limited dependent variable models, and time-series models. Same as ECON 8376. Prerequisite: STAT 8375.

STAT 8998. Advanced Reading and Research. 1-12 Credits.
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit.

STAT 8999. Dissertation Research. 3-12 Credits.
Limited to Doctor of Philosophy candidates. May be repeated for credit.