

# Statistics

The Bachelor of Science degree in Statistics is designed to provide foundations that include basic statistical concepts and methodologies, and to expose students to the role of statistical thinking and analysis in interdisciplinary research and in the public sphere. To ensure deep rigorous understanding of the foundations and main methods of analysis in statistics, the program is composed of three parts: a) foundations in mathematics and computing, combined with an introduction to statistical thinking and practice; b) four core courses on the fundamentals of statistical theory and data analysis; and c) more advanced material covering important areas of statistical methodology. A capstone project involving substantial data analysis or focused on methodology/theory is required. Students also have opportunities to acquire practical experience in study design, data management, and statistical analysis by working as undergraduate research assistants in projects in one of the participating academic departments or Research Centers at Brown.

The Concentration is based on several premises: that statistics is a scientific discipline in its own right, with specialized methodologies and body of knowledge; that it is essentially concerned with the art and science of data analysis; and that it is best taught in conjunction with specific, substantive applications. To this end, the Concentration is designed to provide foundations that include basic statistical concepts and methodologies, and to expose students to the role of statistical thinking and analysis in interdisciplinary research and in the public sphere. The Concentration prepares students for careers in industry and government, for graduate study in statistics or biostatistics and other sciences, as well as for professional study in law, medicine, business, or public administration. The undergraduate concentration guide is available here (<https://www.brown.edu/academics/public-health/biostatistics/undergraduate-statistics-concentration/>).

The Undergraduate Concentration in Statistics is administered by the Department of Biostatistics and leads to a Sc.B. degree. To ensure deep rigorous understanding of the foundations and main methods of analysis in statistics, the program is composed of three parts. The first part entails foundations in mathematics and computing, combined with an introduction to statistical thinking and practice. The second part includes four core courses that provide a comprehensive account of the fundamentals of statistical theory and data analysis. The third part delves into more advanced material covering important areas of statistical methodology. In addition to the formal coursework, students are required to complete a capstone project that involves a substantial data analysis or a methodological/theoretical project. Students also have opportunities to acquire practical experience in study design, data management, and statistical analysis by working as undergraduate research assistants in projects in one of the participating academic Departments or Research Centers at Brown.

The program requires **thirteen** one-semester courses. The required courses are as follows:

<b>LEVEL I: Foundations in Mathematics - Calculus</b>	<b>2</b>
MATH 0100 Single Variable Calculus, Part II	
MATH 0180 Multivariable Calculus	
<b>LEVEL I - Foundations in Mathematics - Linear Algebra</b>	<b>1</b>
MATH 0520 Linear Algebra	
<b>Computing</b>	<b>1</b>
APMA 0160 Introduction to Scientific Computing	
or CSCI 0040 Introduction to Scientific Computing and Problem Solving	
<b>Introduction to Statistical Thinking and Practice</b>	<b>1</b>
PHP 1501 Essentials of Data Analysis	
<b>With the approval of the Director of the Statistics Concentration, one of the following courses may serve as replacement:</b>	
SOC 1100 Introductory Statistics for Social Research	
ECON 1620 Introduction to Econometrics	

APMA 0650 Essential Statistics	
BIOL 0495 Statistical Analysis of Biological Data	
CLPS 0900 Statistical Methods	
<b>LEVEL II - Core Courses in Theory and Data Analysis</b>	<b>2</b>
APMA 1650 Statistical Inference I	
or APMA 1655 Honors Statistical Inference I	
APMA 1660 Statistical Inference II	
<b>OR</b>	
MATH 1210 Probability	
MATH 1620 Mathematical Statistics	
<b>Introduction to Biostatistics</b>	<b>1</b>
PHP 1510 Principles of Biostatistics and Data Analysis	
<b>OR</b>	
PHP 2510 Principles of Biostatistics and Data Analysis	
<b>LEVEL III: Advanced Courses in Statistical Methods</b>	<b>2</b>
PHP 1560 Statistical Programming in R	
<b>OR</b>	
PHP 2560 Statistical Programming with R	
<b>AND</b>	
PHP 1511 Applied Regression Analysis	
<b>OR</b>	
PHP 2511 Applied Regression Analysis	
<b>Capstone Project</b>	<b>1</b>
PHP 1970 Independent Study	
<b>Electives in Social Science and Biostatistics (Students must choose 2)</b>	<b>2</b>
SOC 1120 Market and Social Surveys	
SOC 1340 Principles and Methods of Geographic Information Systems	
SOC 2230 Techniques of Demographic Analysis	
CSCI 1420 Machine Learning	
CSCI 1810 Computational Molecular Biology	
CSCI 1820 Algorithmic Foundations of Computational Biology	
CSCI 1951A Data Science	
PHP 0850 Fundamentals of Epidemiology	
PHP 2030 Clinical Trials Methodology	
PHP 2120 Introduction to Methods in Epidemiologic Research	
PHP 2200 Intermediate Methods in Epidemiologic Research	
PHP 2515 Fundamentals of Probability and Statistical Inference	
PHP 2520 Statistical Inference I	
PHP 2530 Bayesian Statistical Methods	
PHP 2550 Practical Data Analysis	
PHP 2580 Statistical Inference II	
PHP 2602 Analysis of Lifetime Data	
PHP 2601 Linear Models	
PHP 2610 Causal Inference and Missing Data	
PHP 2620 Statistical Methods in Bioinformatics, I	
APMA 1070 Quantitative Models of Biological Systems	
APMA 1080 Inference in Genomics and Molecular Biology	
APMA 1200 Operations Research: Probabilistic Models	
APMA 1690 Computational Probability and Statistics	
APMA 1710 Information Theory	

APMA 1740	Recent Applications of Probability and Statistics
APMA 1860	Graphs and Networks
APMA 2610	Recent Applications of Probability and Statistics
ENGN 2520	Pattern Recognition and Machine Learning
CLPS 1292	Introduction to Programming for the Mind, Brain and Behavior
CLPS 1492	Computational Cognitive Neuroscience
ECON 1360	Health Economics
ECON 1630	Mathematical Econometrics I
ECON 1640	Mathematical Econometrics II
ECON 1660	Big Data
MATH 1810A	Applied Algebraic Topology
Other Analytical/Computational/ Statistical courses with the approval of the Director of the Statistics Concentration	

**Total Credits** **13**

Prospective students will be able to obtain Advanced Placement credit for the requirements in mathematics. Students who have already completed an introductory course in statistics will be granted permission to proceed to Level II core courses if they meet the prerequisites in mathematics and computing.

**PHP 0100:** As part of the capstone course or thesis, students should complete an online course, PHP 0100, at their own pace. This course is a requirement and is meant to give a broad overview of public health and it allows students to see different areas in public health where statistics is being used. The course does not require any additional credit and is completed as part of the independent study, PHP 1970/1980. Students who are in a double concentration in public health are exempt from this course.

**Senior Thesis:** A senior honors thesis is not a requirement for graduation, but concentrators who choose to write one are required to write a manuscript that describes a major project of statistical data analysis that they performed or a simulation study to evaluate the performance of a statistical method. Students that decide to write an honor thesis will generally integrate their capstone project into their thesis. Generally, writing a senior thesis includes two semesters of independent study (PHP 1980), the capstone project may serve as one of those.

**Honors:** Statistics requires the completion of a senior thesis and a superior record in the program.

**Study Abroad/Study Away:** Up to two courses taken elsewhere (study abroad or other transfer) may be applied to required courses. Meet with a concentration adviser to discuss; provide a syllabus for each course to be considered for transfer to your concentration plan.

The program is administered by the Department of Biostatistics, located at 121 South Main Street, 7th floor.

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