## **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 methodolog/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:

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

	APMA 0650	Introduction to Probability and Statistics	
	BIOL 0495	Statistical Analysis of Biological Data	
	CLPS 0900	Statistical Methods	
I	EVEL II - Core Cou	rses in Theory and Data Analysis	2
	APMA 1650	Introduction to Probability and Statistics with Calculus	
	or APMA 1655	Introduction to Probability and Statistics with Theory	
	APMA 1660	Statistical Inference II	
	OR		
	MATH 1210	Probability	
	MATH 1620	Mathematical Statistics	
I	ntroduction to Bios	tatistics	1
	PHP 1510	Principles of Biostatistics and Data Analysis	
	OR		
	PHP 2510	Principles of Biostatistics and Data Analysis	
I	EVEL III: Advanced	d Courses in Statistical Methods	2
	PHP 1560	Using R for Data Analysis	
	OR		
	PHP 2560	Statistical Programming with R	
/	AND		
	PHP 1511	Applied Regression Analysis	
	OR		
	PHP 2511	Applied Regression Analysis	
(	Capstone Project		1
	PHP 1970	Independent Study	
Ì	Electives in Social S	Science and Biostatistics (Students must	2
(	choose 2)	(	
	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	
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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.

For additional information please contact: Roee Gutman, Box G-S-121-7; Telephone: 401-863-2682; Fax: 401-863-9182; e-mail: Roee Gutman (rgutman@stat.brown.edu)