

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.

Statistics equips individuals with the ability to analyze and interpret complex data, a skill essential in a wide range of industries including healthcare, finance, technology, and social sciences. With a solid foundation in statistical methods, students can solve real-world problems using quantitative evidence, making the concentration an excellent choice for those who want to apply mathematical reasoning to diverse and impactful fields.

The concentration is based on the premise that statistics is a scientific discipline that is essentially concerned with the art and science of data analysis and is best taught in conjunction with specific, substantive applications. To this end, the concentration is designed to provide a foundation of basic concepts and methodology, requiring students to take core courses in the discipline itself, and to expose students to a cross-section of statistical applications. Through either a capstone project or senior honors thesis, each student will carry out a major project of statistical data analysis.

The program requires **twelve** one-semester courses.

Pre-Requisites

Single-variable calculus is not an enforced requirement for our concentration, but it is a required prerequisite for many of our courses. At Brown, single-variable calculus consists of MATH 0090 followed by one of MATH 0100, MATH 0170, or MATH 0190.

PHP 1501 Essentials of Data Analysis (AP Statistics with a score of 5 or another approved introductory statistics course may substitute for PHP 1501.)

Mathematical Foundations 1

APMA 0260 Linear Algebra and Multivariable Calculus for Applied Mathematicians Students may opt to take both Multivariable Calculus (MATH 0180, MATH 0200, or MATH 0350) and Linear Algebra (MATH 0520 or MATH 0540) to meet this requirement and count one of these courses towards their general elective requirements.

Statistical Inference and Modeling 4

APMA 1655 Introduction to Probability and Statistics with Theory
or MATH 1210 Probability

APMA 1660 Statistical Inference II
or MATH 1620 Mathematical Statistics

PHP 1560 Using R for Data Analysis
or PHP 2560 Statistical Programming with R

PHP 1511 Applied Regression Analysis

Numerical Methods (Choose 1) 1

APMA 0160 Introduction to Scientific Computing

APMA 1690 Computational Probability and Statistics

ENGN 1950 Advanced Numerical Methods for Data, Simulation, and Optimization

Track Electives (3) 3

Students can choose from the following tracks and must complete three courses within a track. Other courses may be used with the approval of the Director of the Statistics Concentration.

Health Data Science Track

PHP 0850 Fundamentals of Epidemiology

PHP 1480 Introduction To Public Health Economics

PHP 1855 Infectious Disease Modeling

PHP 1854 The Epidemiology and Control of Infectious Diseases

PHP 2514 Applied Generalized Linear Models

PHP 2516 Applied Longitudinal Data Analysis ((Half-credit))

PHP 2517 Applied Multilevel Data Analysis ((Half-credit))

PHP 2650 Statistical Learning and Big Data

PHP 2602 Analysis of Lifetime Data

Econometrics Track

PHP 1480 Introduction To Public Health Economics

ECON 1630 Mathematical Econometrics I

ECON 1640 Mathematical Econometrics II

ECON 1360 Research Seminar in Health Economics

ECON 1629 Applied Research Methods for Economists

ECON 1670 Advanced Topics in Econometrics

APMA 1200 Operations Research: Probabilistic Models

APMA 1720 Monte Carlo Simulation with Applications to Finance

Statistical Theory Track

APMA 1740 Recent Applications of Probability and Statistics

APMA 1670 Statistical Analysis of Time Series

APMA 1680 Nonparametric Statistics

APMA 1690 Computational Probability and Statistics

MATH 1630 Real Analysis I

PHP 2515 Fundamentals of Probability and Statistical Inference
or PHP 2520 Statistical Inference I

PHP 2610 Causal Inference and Missing Data

PHP 2530 Bayesian Statistical Methods

Interdisciplinary Track

Students may design their own track with the approval of the Director of the Undergraduate Concentration.

General Electives (Choose 2) 2

Students must choose two general elective courses. Pre-approved courses are listed below, but courses may also be chosen from those courses listed in the track electives. Other courses may be used with the approval of the Director of the Statistics Concentration.

APMA 1080 Inference in Genomics and Molecular Biology

APMA 1160 An Introduction to Numerical Optimization

APMA 1210 Operations Research: Deterministic Models

APMA 1710 Information Theory

APMA 1860 Graphs and Networks

BIOL 1435 Computational Methods for Studying Demographic History with Molecular Data

CSCI 1420 Machine Learning

CSCI 1430 Computer Vision

CSCI 1470	Deep Learning	
CSCI 1491	Fairness in Automated Decision Making	
CSCI 1520	Algorithmic Aspects of Machine Learning	
CSCI 1810	Computational Molecular Biology	
CSCI 1820	Algorithmic Foundations of Computational Biology	
CSCI 1951A	Data Science	
ENGN 2520	Pattern Recognition and Machine Learning	
SOC 1120	Market and Social Surveys	
SOC 1340	Principles and Methods of Geographic Information Systems	
SOC 2230	Techniques of Demographic Analysis	
SOC 2960G	Spatial Data Analysis Techniques in the Social Sciences	
Capstone Project		1
PHP 1970	Independent Study	
or PHP 1980	Honors Thesis Preparation	
Total Credits		12

PHP 2000: As part of the concentration, students should complete an online course, PHP 2000, 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 is a non-credit, asynchronous, online course that is required for all students within the School of Public Health. Students who are in a double concentration in public health are exempt from this course.

Double Concentrations: Students may count up to three courses towards another concentration. This cannot include your capstone project or honors thesis. You must declare an additional concentration no later than your seventh semester.

Senior Thesis/Capstone: Statistics concentrators have the option to complete either a capstone project or an honors thesis. Students who complete a thesis and enroll in PHP 1980 for two semesters may count one semester towards their general statistics elective requirements.

Honors:

Students who wish to achieve honors must complete a senior honors thesis and obtain grades of A or S-with-distinction in at least 70% of the Brown University courses used for concentration credit.

Students pursuing a senior honors thesis undertake an independent research project over two semesters, under the guidance of a faculty advisor. Either the faculty advisor or an additional reader must be a faculty member in the Department of Biostatistics. Students are required to produce a manuscript on their project, which is submitted to the University. Thesis projects may involve a major data analysis, the design of a simulation study to assess the performance of a statistical method, or contributions to the development of new statistical methods.

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: Alice Paul
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