# DATA SCIENCE (BS)

**CIP:** 11.1099

## Program Description

Data Science at NYU Shanghai is designed to create data-driven leaders with a global perspective, a broad education, and the capacity to think creatively. Data science involves using computerized methods to analyze massive amounts of data and to extract knowledge from them. Data science addresses a wide range of data types, including scientific and economic numerical data, textual data, and image and video data. This new discipline draws from methodologies and tools in several well-established fields, including computer science, statistics, applied mathematics, and economics. Data science has applications in just about every academic discipline, including sociology, political science, digital humanities, linguistics, finance, marketing, urban informatics, medical informatics, genomics, image content analysis, and all branches of engineering and the physical sciences. The importance of data science is expected to accelerate in the coming years, as data from the web, mobile sensors, smartphones, and Internet-connected instruments continues to grow.

Students who complete the major will not only have expertise in computer programming, statistics, and data mining, but also know how to combine these tools to solve contemporary problems in a discipline of their choice, including the social science, physical science, and engineering disciplines. Upon graduation, data science majors have numerous career paths. Data Science majors can go on to graduate school in data science, computer science, social science, business, finance, medicine, law, linguistics, education, and so on. Outside of academia, there are also myriad career paths. Not only can graduates pursue careers with traditional data-driven computer-science companies and startups such as Google, Facebook, Amazon, and Microsoft, but also they can also be valuable to companies in the transportation, energy, medical, and financial sectors. Graduates can also pursue careers in the public sector, including urban planning, law enforcement, and education.

## Admissions

New York University's Office of Undergraduate Admissions supports the application process for all undergraduate programs at NYU. For additional information about undergraduate admissions, including application requirements, see How to Apply (https://www.nyu.edu/admissions/undergraduate-admissions/how-to-apply.html).

## Program Requirements

| Course | Title | Credits |
|---|---|---|
| **Core Courses** | | |
| *Social and Cultural Foundations* | | |
| CCSF-SHU 101L | Global Perspectives on Society | 4 |
| Interdisciplinary Perspectives on China (Two Courses) | | 8 |
| *Writing* | | |
| WRIT-SHU 102 | Writing as Inquiry | 4 |
| WRIT-SHU 201 | Perspectives on the Humanities | 4 |
| *Language* | | |
| Language Courses [1] | | 8-16 |
| *Mathematics* | | |
| Mathematics Requirement Fulfilled by Major Coursework | | |
| *Algorithmic Thinking* | | |
| Algorithmic Thinking Requirement Fulfilled by Major Coursework | | |
| *Science* | | |
| Experimental Discovery in the Natural World | | 4 |
| Science, Technology, and Society | | 4 |
| **Major Requirements** | | |
| *Foundational Courses* | | |
| CSCI-SHU 101 | Introduction to Computer and Data Science | 4 |
| Select one of the following: | | 4 |
| BUSF-SHU 101 | Statistics for Business and Economics | |
| MATH-SHU 235 | Probability and Statistics | |
| MATH-SHU 238 | Honors Theory of Probability | |
| *Programming & Computer Science* | | |
| CSCI-SHU 210 | Data Structures | 4 |
| *Mathematics* | | |
| Select one of the following: | | 4 |
| MATH-SHU 151 | Multivariable Calculus | |
| MATH-SHU 328 | Honors Analysis I | |
| Select one of the following: | | 4 |
| MATH-SHU 140 | Linear Algebra | |
| MATH-SHU 141 | Honors Linear Algebra I | |
| MATH-SHU 265 | Linear Algebra and Differential Equation | |
| *Data Analysis* | | |
| CSCI-SHU 360 | Machine Learning | 4 |
| Select one of the following: | | 4 |
| ECON-SHU 301 | Econometrics | |
| MATH-SHU 234 | Mathematical Statistics | |
| Select one of the following: | | 4 |
| CSCI-SHU 220 | Algorithms | |
| DATS-SHU 235 | Information Visualization | |
| DATS-SHU 240 | Introduction to Optimization and Mathematical Programming | |
| *Data Management* | | |
| CSCI-SHU 213 | Databases | 4 |
| *Capstone Course* [2] | | |
| DATS-SHU 420 | Data Science Senior Project | 4 |
| *Concentration Courses* | | |
| Complete one of the following Concentrations: | | 8-16 |
| Finance | | |
| Marketing | | |
| Economics | | |
| Genomics | | |
| Mathematics | | |
| Artificial Intelligence | | |
| Political Science | | |

| | |
|---|---|
| Psychology | |
| **Electives** | **28-44** |
| **Total Credits** | **128** |

1 Students who did not attend a Chinese-medium high school fulfill the Core language requirement by demonstrating proficiency of the Chinese language through the Intermediate level. Chinese speakers who did not attend an English-medium high school fulfill the Core language requirement through completion of EAP-SHU 100 English for Academic Purposes I and EAP-SHU 101 English for Academic Purposes II . Additional information can be found on the NYU Shanghai Core Curriculum page (https://bulletins.nyu.edu/undergraduate/shanghai/core-curriculum/#text).

2 Students who are admitted in Business and Econ Honors Program can enroll in ECON-SHU 453 Economics Honors Seminar/BUSF-SHU 3 Business and Economics Honors Seminar to fulfill Data Science capstone requirement.

# Data Science Concentrations

## Finance

| Course | Title | Credits |
|---|---|---|
| ECON-SHU 3 | Microeconomics | 4 |
| BUSF-SHU 202 | Foundations of Finance | 4 |
| BUSF-SHU 250 | Principles of Financial Accounting | 4 |
| BUSF-SHU 303 | Corporate Finance | 4 |
| **Total Credits** | | **16** |

## Marketing

| Course | Title | Credits |
|---|---|---|
| ECON-SHU 3 | Microeconomics | 4 |
| BUSF-SHU 202 | Foundations of Finance | 4 |
| BUSF-SHU 250 | Principles of Financial Accounting | 4 |
| MKTG-SHU 1 | Introduction to Marketing | 4 |
| **Total Credits** | | **16** |

## Economics

| Course | Title | Credits |
|---|---|---|
| ECON-SHU 1 | Principles of Macroeconomics | 4 |
| ECON-SHU 3 | Microeconomics | 4 |
| **Total Credits** | | **8** |

## Genomics

| Course | Title | Credits |
|---|---|---|
| BIOL-SHU 21 | Foundations of Biology I | 3 |
| BIOL-SHU 22 | Foundations of Biology II | 3 |
| BIOL-SHU 123 | Foundations of Biology Lab | 2 |
| BIOL-SHU 261 | Genomics and Bioinformatics | 4 |
| **Total Credits** | | **12** |

## Mathematics

| Course | Title | Credits |
|---|---|---|
| Select two of the following: | | 8 |
| MATH-SHU 142 | Honors Linear Algebra II | |
| MATH-SHU 234 | Mathematical Statistics | |
| MATH-SHU 238 | Honors Theory of Probability | |
| MATH-SHU 329 | Honors Analysis II | |
| MATH-SHU 345 | Introduction to Stochastic Processes | |
| **Total Credits** | | **8** |

## Artificial Intelligence

| Course | Title | Credits |
|---|---|---|
| Select two of the following: | | 8 |
| CSCI-SHU 220 | Algorithms | |
| CSCI-SHU 375 | Reinforcement Learning | |
| CSCI-SHU 376 | Natural Language Processing | |
| CSCI-SHU 381 | Recommendation Systems | |
| DATS-SHU 200 | Topics in Machine Learning | |
| DATS-SHU 235 | Information Visualization | |
| DATS-SHU 240 | Introduction to Optimization and Mathematical Programming | |
| DATS-SHU 377 | Computer Vision | |
| **Total Credits** | | **8** |

## Political Science

| Course | Title | Credits |
|---|---|---|
| SOCS-SHU 150 | Introduction to Comparative Politics | 4 |
| SOCS-SHU 160 | Introduction to International Politics | 4 |
| **Total Credits** | | **8** |

## Psychology

| Course | Title | Credits |
|---|---|---|
| PSYC-SHU 101 | Introduction to Psychology | 4 |
| Select two of the following: | | 8 |
| PSYC-SHU 234 | Developmental Psychology | |
| PSYC-SHU 352 | Psychology of Human Sexuality | |
| SOCS-SHU 334 | Legal Psychology | |
| SOCS-SHU 350 | Empirical Research Practice | |
| **Total Credits** | | **12** |

# Sample Plan of Study

| Course | Title | Credits |
|---|---|---|
| **1st Semester/Term** | | |
| CCSF-SHU 101L | Global Perspectives on Society | 4 |
| MATH-SHU 131 | Calculus | 4 |
| CSCI-SHU 11 | Introduction to Computer Programming | 4 |
| Language Course | | 4 |
| | **Credits** | **16** |
| **2nd Semester/Term** | | |
| WRIT-SHU 102 | Writing as Inquiry | 4 |
| MATH-SHU 235 | Probability and Statistics | 4 |
| CSCI-SHU 101 or CSCI-SHU 210 | Introduction to Computer and Data Science or Data Structures | 4 |

| | | |
|---|---|---|
| Language Course | | 4 |
| | **Credits** | **16** |
| **3rd Semester/Term** | | |
| WRIT-SHU 201 | Perspectives on the Humanities | 4 |
| Select one of the following: | | 4 |
| CSCI-SHU 210 | Data Structures | |
| Concentration Course | | |
| MATH-SHU 151 | Multivariable Calculus | 4 |
| Language Course or Core Course | | 4 |
| | **Credits** | **16** |
| **4th Semester/Term** | | |
| MATH-SHU 140 | Linear Algebra | 4 |
| CSCI-SHU 360 | Machine Learning | 4 |
| ECON-SHU 301<br>or MATH-SHU 234 | Econometrics<br>or Mathematical Statistics | 4 |
| Language Course or Core Course | | 4 |
| | **Credits** | **16** |
| **5th Semester/Term** | | |
| Core or General Elective | | 4 |
| CSCI-SHU 213 | Databases | 4 |
| Concentration Course | | 4 |
| General Elective | | 4 |
| | **Credits** | **16** |
| **6th Semester/Term** | | |
| Core or General Elective | | 4 |
| Core Class | | 4 |
| Concentration Course or General Elective | | 4 |
| General Elective | | 4 |
| | **Credits** | **16** |
| **7th Semester/Term** | | |
| DATS-SHU 420 | Data Science Senior Project | 4 |
| Data Science Concentration Course or General Elective | | 4 |
| General Elective | | 4 |
| Senior Project | | 4 |
| | **Credits** | **16** |
| **8th Semester/Term** | | |
| General Elective | | 4 |
| General Elective | | 4 |
| General Elective | | 4 |
| General Elective | | 4 |
| | **Credits** | **16** |
| | **Total Credits** | **128** |

# Learning Outcomes

Upon successful completion of this program, students will:

1. Develop the logical and mathematical capability to identify and analyze problems.
2. Develop proficiency in programming in a general purpose, high level programming language.
3. Have a sound understanding of the field of data science, and the ability to analyze, model and visualize data using some of its main methods to gain insights and make decisions.
4. Be able to combine mathematics, computer programming and data science tools to solve contemporary problems in a specialty area within data science such as biology, finance.

# Policies

## Prerequisite Courses for Declaring a Major

Final grade of C/current semester midterm grade of B or higher in Introduction to Computer Programming OR Introduction to Computer and Data Science + Calculus.

## Policy on Double-Counting of Courses

Computer science and data science share many courses, so double-majoring is not allowed. However, Students in data science can minor in computer science.

## NYU Policies

University-wide policies can be found on the New York University Policy pages (https://bulletins.nyu.edu/nyu/policies/).

## NYU Shanghai Policies

Additional academic policies can be found on the NYU Shanghai Academic Policies page (https://bulletins.nyu.edu/undergraduate/shanghai/academic-policies/).