# DATA SCIENCE AND MATHEMATICS (BA)

Department Website (http://math.nyu.edu)

**NYSED:** 41255 **HEGIS:** 1702.00 **CIP.** 30.7001

## Program Description

The joint major in Data Science and Mathematics achieves the objectives of the Data Science major while enabling students to pursue a deep study of mathematics, particularly the areas of mathematics most relevant to statistics, data science, machine learning, and artificial intelligence.

This interdisciplinary major comprises 18 courses (72 credits) offered by the Center for Data Science and Courant's Department of Mathematics. Students in this program are required to complete a full sequence of upper level probability and upper level statistics. These proof based intensive courses prepare students for advanced pursuits in data science and in graduate school.

Students may contact cds-undergraduate@nyu.edu with questions.

## Honors Program

This major program of study does not currently offer an honors track.

## 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

The joint major in Data Science and Mathematics requires eighteen 4-credit courses (72 credits) as outlined below.

| Course | Title | Credits |
| --- | --- | --- |
| **General Education Requirements** | | |
| First-Year Seminar | | 4 |
| EXPOS-UA 1 | Writing as Inquiry | 4 |
| Foreign Language [1] | | 16 |
| Physical Science | | 4 |
| Life Science | | 4 |
| Texts and Ideas | | 4 |
| Cultures and Contexts | | 4 |
| Societies and the Social Sciences | | 4 |
| Expressive Culture | | 4 |
| **Major Requirements** | | |
| *Data Science Requirements* | | |
| DS-UA 111 | Principles of Data Science I (offered every semester) | 4 |
| DS-UA 112 | Principles of Data Science II (offered every semester) | 4 |
| DS-UA 201 | Causal Inference (offered every semester) | 4 |
| DS-UA 202 | Responsible Data Science (offered every Spring) | 4 |
| DS-UA 301 | Advanced Topics in Data Science (offered every semester) | 4 |
| *Mathematics Requirements* | | |
| MATH-UA 120 | Discrete Mathematics | 4 |
| MATH-UA 121 | Calculus I | 4 |
| MATH-UA 122 | Calculus II | 4 |
| MATH-UA 123 or MATH-UA 129 | Calculus III or Honors Calculus III | 4 |
| MATH-UA 140 or MATH-UA 148 | Linear Algebra or Honors Linear Algebra | 4 |
| MATH-UA 325 or MATH-UA 328 | Analysis or Honors Analysis I | 4 |
| MATH-UA 333 or MATH-UA 338 | Theory of Probability (formerly UA 233) or Honors Theory of Probability | 4 |
| MATH-UA 334 | Mathematical Statistics (formerly UA 234) | 4 |
| MATH-UA 352 | Numerical Analysis (formerly UA 252) | 4 |
| *Computer Science Requirements* | | |
| CSCI-UA 2 | Introduction to Computer Programming (No Prior Experience) [2] | 4 |
| CSCI-UA 101 | Intro to Computer Science | 4 |
| CSCI-UA 102 | Data Structures | 4 |
| CSCI-UA 473 | Fundamentals of Machine Learning | 4 |
| CSCI-UA 479 | Data Management and Analysis | 4 |
| **Electives** | | |
| Other Elective Credits | | 4 |
| **Total Credits** | | **128** |

[1] The foreign language requirement is satisfied upon successful completion through the Intermediate level of a language. This may be accomplished in fewer than 16 credits, but those credits must then be completed as elective credit.

[2] This course does not count towards the major but is a required prerequisite for CSCI-UA 101 Intro to Computer Science. Students who place out of this prerequisite simply replace it with a general degree elective.

## Sample Plan of Study

| Course | Title | Credits |
| --- | --- | --- |
| **1st Semester/Term** | | |
| CSCI-UA 2 | Introduction to Computer Programming (No Prior Experience) [1] | 4 |
| MATH-UA 121 | Calculus I | 4 |
| Texts and Ideas | | 4 |
| First-Year Seminar | | 4 |
| | **Credits** | **16** |
| **2nd Semester/Term** | | |
| CSCI-UA 101 | Intro to Computer Science | 4 |
| MATH-UA 122 | Calculus II | 4 |
| Cultures and Contexts | | 4 |
| EXPOS-UA 1 | Writing as Inquiry | 4 |
| | **Credits** | **16** |

**3rd Semester/Term**

| | | |
|---|---|---|
| DS-UA 111 | Principles of Data Science I | 4 |
| CSCI-UA 102 | Data Structures | 4 |
| MATH-UA 123<br>  or MATH-UA 129 | Calculus III<br>  or Honors Calculus III | 4 |
| Foreign Language | | 4 |
| | **Credits** | **16** |

**4th Semester/Term**

| | | |
|---|---|---|
| DS-UA 112 | Principles of Data Science II | 4 |
| MATH-UA 120 | Discrete Mathematics | 4 |
| MATH-UA 140<br>  or MATH-UA 148 | Linear Algebra<br>  or Honors Linear Algebra | 4 |
| Foreign Language | | 4 |
| | **Credits** | **16** |

**5th Semester/Term**

| | | |
|---|---|---|
| CSCI-UA 479 | Data Management and Analysis | 4 |
| MATH-UA 333<br>  or MATH-UA 338 | Theory of Probability<br>  or Honors Theory of Probability | 4 |
| Foreign Language | | 4 |
| Expressive Culture | | 4 |
| | **Credits** | **16** |

**6th Semester/Term**

| | | |
|---|---|---|
| MATH-UA 325<br>  or MATH-UA 328 | Analysis<br>  or Honors Analysis I | 4 |
| MATH-UA 334 | Mathematical Statistics | 4 |
| Foreign Language | | 4 |
| Societies and the Social Sciences | | 4 |
| | **Credits** | **16** |

**7th Semester/Term**

| | | |
|---|---|---|
| DS-UA 201 | Causal Inference | 4 |
| CSCI-UA 473 | Fundamentals of Machine Learning | 4 |
| Physical Science | | 4 |
| Other Elective Credits | | 4 |
| | **Credits** | **16** |

**8th Semester/Term**

| | | |
|---|---|---|
| DS-UA 202 | Responsible Data Science | 4 |
| DS-UA 301 | Advanced Topics in Data Science | 4 |
| MATH-UA 352 | Numerical Analysis | 4 |
| Life Science | | 4 |
| | **Credits** | **16** |
| | **Total Credits** | **128** |

[1]  This course does not count towards the joint major but is a required prerequisite for CSCI-UA 101 Intro to Computer Science.

# Learning Outcomes

Upon completion of program requirements, students are expected to:

1. Achieve a rigorous understanding of the mathematical, statistical, and computational principles that underpin data science, so that students will have the foundational mastery to pursue of the many applications of data sciences without limitation.

2. Understand approaches such as causal inference, machine learning, and data management that are involved in different settings across varied academic and applied contexts.

3. Examine the relationship between data science and society by addressing ethical and philosophical issues in modern statistics, data science, and AI, and develop the ability not only to design data models but also to communicate effectively about these models and their outputs.

4. Achieve proficiency in the foundations of modern mathematics, including discrete mathematics, calculus, and analysis.

5. Be able to communicate mathematically, including understanding, developing, and critiquing mathematical arguments and rigorous proofs.

# Policies

## Program Policies

### Policy on Declaration of Major

Students must complete either DS-UA 111 Principles of Data Science I or DS-UA 112 Principles of Data Science II with a C or better before declaring the joint major in Data Science and Mathematics. This policy applies to all NYU students, not just to those matriculated in CAS.

Students are not able to double major in Mathematics and Data Science. To pursue both disciplines, students must declare this joint major.

Students may declare at any time during the academic year using the links below. Any questions or concerns regarding the declaration process should be directed to cds-undergraduate@nyu.edu.

- Data Science Major or Minor (https://docs.google.com/forms/d/e/1FAIpQLSdvU0oTPxa_c8DPzyywxw7LNmofGbfoSaVhz0Dcx4SuksgixA/viewform/?usp=sf_link)
- Joint Major in Computer and Data Science (https://docs.google.com/forms/d/e/1FAIpQLSfq5ZHkrnd0jvST5Mq_dF1bEfHYVolAxJ_y-9pMuPgGdZoZpQ/viewform/?usp=sf_link) (all NYU students must complete both DS-UA 111 Principles of Data Science I and CSCI-UA 101 Introduction to Computer Science with a grade of C or better before declaring this major)
- Joint Major in Data Science and Mathematics (https://docs.google.com/forms/d/e/1FAIpQLSffkc8dTgivZTNrToggDAXOtniEwPMr82EqSxOcSPZExReaUg/viewform/?usp=sf_link)

College of Arts and Science students cannot enter their junior year undeclared and must begin their data science (and, if applicable, computer science) course sequence no later than the spring semester of their sophomore year, which will allow them to declare the major or minor during the summer before their junior year. The Center for Data Science (CDS) and CAS both advise that students begin their data science courses earlier and declare the major in the spring of their sophomore year. Although students may begin their data science courses later than this point, there is no guarantee they will finish their major requirements in time to graduate within four years. Students cannot declare any major or joint major with CDS after completion of their junior year.

### Grading Policy

A grade of C or higher is required in all courses used to fulfill joint major requirements (courses taken under the Pass/Fail option cannot be counted toward the major).

### Required Coursework in CAS (-UA) for all Majors and Minors in Courant

At least half of the courses applied to the Courant requirements of the CAS majors and minors in Computer Science and in Mathematics (including joint programs) must be CSCI-UA and MATH-UA courses taken in New York or at NYU study away sites. This is a built-in limit on how many courses students may take in these subjects that are (for example) sponsored by NYU Abu Dhabi and NYU Shanghai under CS-UH, MATH-UH, CENG-SHU, CSCI-SHU, and MATH-SHU. Internal and external transfers

must pay close attention to this policy, but it also applies to students who matriculate as first-years. The usual CAS policies on -UA residency for the baccalaureate degree still apply.

## NYU Policies

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

## College of Arts and Science Policies

A full list of relevant academic policies can be found on the CAS Academic Policies page (https://bulletins.nyu.edu/undergraduate/arts-science/academic-policies/).