MATHEMATICS AND COMPUTER SCIENCE (BA)

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

NYSED: 27024 **HEGIS:** 1799.00 **CIP:** 11.0101

Program Description

An interdisciplinary major offered jointly by the Department of Mathematics and Computer Science, providing the opportunity to study both computer science and such relevant mathematics courses as analysis, algebra, probability, and statistics.

Honors Program in Computer Science and Mathematics

The prerequisite for declaring this major is completion of either CSCI-UA 101 Intro to Computer Science or CSCI-UA 102 Data Structures (depending on placement) with a C or better.. This is a twenty-course (80-credit) interdisciplinary major offered by the Departments of Computer Science and Mathematics.

The honors degree will be awarded to students with outstanding performance in the program. To be eligible for this distinction students must:

1. Complete all college BA requirements including at least 64 credits of graded work in the College of Arts & Science.
2. Complete all of the course requirements for the program.
3. Maintain a grade point average of **3.65** or better in the major sequence (including honors requirements) **AND** maintain a general grade point average of **3.65** or better.
4. Request admission to the honors program by completing the **Honors Admission Request Form**.
5. Meet with the computer science Program Administrator and Director of Undergraduate Studies to discuss the program requirements once you have been admitted.
6. Meet with your mentor at least twice during the academic year, once in October and once in March, prior to registering for the following semester.
7. Students are required to submit a copy of their completed thesis to their Faculty Advisor, as well as to the Director of Undergraduate Studies, Marsha Berger - berger@cims.nyu.edu.

Course	Title	Credits
Required Honors Courses		
Computer Science Requirements		
CSCI-UA 101	Intro to Computer Science	4
CSCI-UA 102	Data Structures	4
CSCI-UA 201	Computer Systems Org	4
CSCI-UA 202	Operating Systems	4
CSCI-UA 310	Basic Algorithms	4
CSCI-UA 421	Numerical Computing	4
CSCI-UA 453	Theory of Computation	4
Select three computer science courses listed at the CSCI-UA 400 level		12
Mathematics Requirements		
MATH-UA 121	Calculus I	4
MATH-UA 122	Calculus II	4
MATH-UA 123	Calculus III	4
or MATH-UA 129	Honors Calculus III	
MATH-UA 140	Linear Algebra	4
or MATH-UA 148	Honors Linear Algebra	
MATH-UA 325	Analysis	4
or MATH-UA 328	Honors Analysis I	
MATH-UA 329	Honors Analysis II	4
MATH-UA 343	Algebra	4
or MATH-UA 348	Honors Algebra I	
MATH-UA 349	Honors Algebra II	4
Select two of the following:		8
MATH-UA 238	Honors Theory of Probability	
MATH-UA 258	Honors Numerical Analysis	
MATH-UA 268	Honors Ordinary Differential Equations	
MATH-UA 393		
MATH-UA 394		
MATH-UA 397		
MATH-UA 398		
Total Credits		**80**

Guided research, sponsored by either department, should be presented at the Dean's Undergraduate Research Conference which takes place in late April. Students are expected to dedicate 10 to 20 hours per week toward their research. The research project can also be completed through the mathematics summer research program (SURE or AM-SURE). Students who participate in the SURE program are required to present their research at the undergraduate research forum at Courant in the fall semester of their senior year.

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 prerequisite for declaring this major is completion of either CSCI-UA 101 Intro to Computer Science or CSCI-UA 102 Data Structures (depending on placement) with a C or better. This is an interdisciplinary major (eighteen courses/72 credits) offered by the Department of Mathematics with the Department of Computer Science.

Students may double-count no more than two courses towards both this joint major and the requirements of another major or minor. A grade of C or higher is necessary in all courses used to fulfill joint major requirements (courses taken under the Pass/Fail option cannot be counted toward the major). Interested students should consult with the directors of undergraduate studies in both departments for additional information.

Course	Title	Credits
General Education Requirements		
First-Year Seminar		4
EXPOS-UA 1	Writing The Essay:	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		
Mathematics Requirements [2]		
Students must choose one calculus track or the other and cannot mix courses from the two tracks.		
MATH-UA 120	Discrete Mathematics	4
Select one of the following:		4
MATH-UA 121	Calculus I	
MATH-UA 131	Mathematics for Economics I	
Select one of the following:		4
MATH-UA 122	Calculus II	
MATH-UA 132	Mathematics for Economics II	
Select one of the following:		4
MATH-UA 123	Calculus III	
MATH-UA 129	Honors Calculus III	
MATH-UA 133	Mathematics for Economics III	
MATH-UA 140	Linear Algebra	4
or MATH-UA 148	Honors Linear Algebra	
MATH-UA 325	Analysis	4
or MATH-UA 328	Honors Analysis I	
MATH-UA 343	Algebra	4
or MATH-UA 348	Honors Algebra I	
Remaining Mathematics Courses:		
Select three mathematics courses. Two must be selected from the following: [3]		12
MATH-UA 233	Theory of Probability	
or MATH-UA 238	Honors Theory of Probability	
MATH-UA 234	Mathematical Statistics	
MATH-UA 240	Combinatorics	
MATH-UA 248	Theory of Numbers	
MATH-UA 251	Intro to Math Modeling	
MATH-UA 252	Numerical Analysis [4]	
or MATH-UA 258	Honors Numerical Analysis	
MATH-UA 253	Linear and Nonlinear Optimization	
MATH-UA 262	Ordinary Diff Equations	
or MATH-UA 268	Honors Ordinary Differential Equations	
MATH-UA 263	Partial Diff Equations	
MATH-UA 264	Chaos & Dynamical Systems	
MATH-UA 282	Functions of a Complex Variable	
MATH-UA 329	Honors Analysis II	
MATH-UA 349	Honors Algebra II	
MATH-UA 375	Topology	
MATH-UA 377	Differential Geometry	
MATH-UA 393		
MATH-UA 394		
MATH-UA 397		
MATH-UA 398		
Computer Science Requirements		
CSCI-UA 2	Introduction to Computer Programming (No Prior Experience) [5]	4
CSCI-UA 101	Intro to Computer Science	4
CSCI-UA 102	Data Structures	4
CSCI-UA 201	Computer Systems Org	4
CSCI-UA 202	Operating Systems	4
CSCI-UA 310	Basic Algorithms	4
CSCI-UA 421	Numerical Computing	4
Electives		
Select two computer science electives at the 400 level		8
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

The mathematics requirements (ten courses/40 credits) are as follows. Students must choose one calculus sequence or the other and cannot mix courses from both. Students also cannot register simultaneously for separate courses within the two sequences.

3

If MATH-UA 235 Probability & Statistics is taken, then MATH-UA 233 Theory of Probability or MATH-UA 238 Honors Theory of Probability and/or MATH-UA 234 Mathematical Statistics may not be counted toward the major requirements; also note that if MATH-UA 233 Theory of Probability or MATH-UA 238 Honors Theory of Probability and/or MATH-UA 234 Mathematical Statistics is taken, then MATH-UA 235 Probability & Statistics may not be counted toward the major requirements. In addition, all mathematics electives for the joint major must be numbered at or above MATH-UA 120 Discrete Mathematics.

4

Students who take MATH-UA 252 Numerical Analysis or MATH-UA 258 Honors Numerical Analysis as one of their mathematics electives for this major must contact the director of undergraduate studies in computer science before registering for CSCI-UA 421 Numerical Computing.

5

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

Sample Plan of Study

Course	Title	Credits
1st Semester/Term		
MATH-UA 121 or MATH-UA 131	Calculus I or Mathematics for Economics I	4
MATH-UA 120	Discrete Mathematics	4
CSCI-UA 2	Introduction to Computer Programming (No Prior Experience)	4
First-Year Seminar		4
	Credits	**16**
2nd Semester/Term		
MATH-UA 122 or MATH-UA 132	Calculus II or Mathematics for Economics II	4
MATH-UA 140 or MATH-UA 148	Linear Algebra or Honors Linear Algebra	4
CSCI-UA 101	Intro to Computer Science	4
EXPOS-UA 1	Writing The Essay:	4
	Credits	**16**
3rd Semester/Term		
MATH-UA 123 or MATH-UA 129	Calculus III or Honors Calculus III	4
CSCI-UA 102	Data Structures	4
Texts and Ideas		4
Foreign Language I		4
	Credits	**16**
4th Semester/Term		
MATH-UA 325 or MATH-UA 328	Analysis or Honors Analysis I	4
CSCI-UA 201	Computer Systems Org	4
Cultures and Contexts		4
Foreign Language II		4
	Credits	**16**
5th Semester/Term		
MATH-UA 343 or MATH-UA 348	Algebra or Honors Algebra I	4
CSCI-UA 202	Operating Systems	4
Foreign Language III		4
Expressive Culture		4
	Credits	**16**
6th Semester/Term		
Mathematics Major Elective (#1 of 3) [1]		4
CSCI-UA 310	Basic Algorithms	4
Foreign Language IV		4
Societies and the Social Sciences		4
	Credits	**16**
7th Semester/Term		
Mathematics Major Elective (#2 of 3) [1]		4
CSCI-UA 421	Numerical Computing	4
Computer Science Major Elective (400-Level) (#1 of 2)		4
Physical Science		4
	Credits	**16**
8th Semester/Term		
Mathematics Major Elective (#3 of 3)		4
Computer Science Major Elective (400-Level) (#2 of 2)		4
Life Science		4
Other Elective Credits		4
	Credits	**16**
	Total Credits	**128**

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Two of the three must be drawn from a list of specific advanced electives in the program of study

Recommended Sequence for Majors in Mathematics

For students placing into Calculus I (MATH-UA 121):

- First semester: Calculus I (MATH-UA 121), possibly with Discrete Mathematics (MATH-UA 120)
- Second semester: Calculus II (MATH-UA 122), and Discrete Mathematics if not yet taken
- Third semester Calculus III (MATH-UA 123) and Linear Algebra or Honors Linear Algebra (MATH-UA 140 or 148)
- Fourth semester: Analysis or Honors Analysis I (MATH-UA 325 or 328)

For students placing into Calculus II (MATH-UA 122):

- First semester: Calculus II (MATH-UA 122) and Discrete Mathematics (MATH-UA 120)
- Second semester: Calculus III or Honors Calculus III (MATH-UA 123 or 129), and Linear Algebra or Honors Linear Algebra (MATH-UA 140 or 148)
- Third semester: Analysis or Honors Analysis I (MATH-UA 325 or 328)

For students placing into Calculus III (MATH-UA 123):

- First semester: Calculus III or Honors Calculus III (MATH-UA 123 or 129), possibly with Discrete Mathematics (MATH-UA 120)
- Second semester: Linear Algebra or Honors Linear Algebra (MATH-UA 140 or 148), and Discrete Mathematics (MATH-UA 120) if not yet taken
- Third semester: Analysis or Honors Analysis I (MATH-UA 325 or 328)

Learning Outcomes

Upon completion of program requirements, students are expected to have acquired:

1. Skills in writing computer programs and designing software systems.
2. An understanding of the foundational algorithms and data structures used in computer software.
3. An understanding of what is going on "under the hood" of computer software in terms of the underlying computer architecture and operating systems.
4. Advanced knowledge of some specific areas of computer science and its applications.
5. Proficiency in the foundations of modern mathematics, including discrete mathematics, calculus, analysis, and algebra.
6. The ability to communicate mathematically, including understanding, developing, and critiquing mathematical arguments and rigorous proofs.
7. The ability to apply mathematical ideas and methods to questions and problems both within and outside of the mathematical sciences.
8. Advanced knowledge in some specific areas of mathematics, such as differential equations, geometry and topology, complex analysis, probability and statistics, number theory, or numerical analysis.

Policies

Policies Applying to the Major

Note: *Students must complete CSCI-UA 101, Introduction to Computer Science (or higher) with a grade of C or better before they may declare a major in this department.*

Restrictions on Majors

Please note the following restrictions on the majors in our department:

1. Tandon students are not permitted to declare a major in Computer Science, Computer Science/Math, Computer Science/Economics, or Computer Science/Data Science at CAS, as there are similar programs available at Tandon.
2. Data Science majors are not permitted to declare a double major in Computer Science, Computer Science/ Math or Computer Science/ Economics, as there is significant course overlap. Students interested in Computer Science, Data Science and Math should consider a joint major in Computer Science/ Data Science.

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/).