

Quick Guide for the CS@CU MS Bridge Program in Computer Science

I. Bridge Program Curriculum

This Quick Guide is for CS@CU MS Bridge Program students completing their Bridge curriculum, typically over the first two or three semesters. CS@CU MS Bridge Program students first study a foundational curriculum comprising one calculus course and four computer science courses. They then take two track courses depending on their intended MS specialization.

Calculus Requirement (3 points)

Students are required to take **Calculus I (MATH UN1101, 3pts)** or its equivalent. This course covers functions, limits, single-variable differentiation, and single-variable integration.

CS Bridge Core Curriculum (14-15 points)

The core curriculum for CS@CU MS Bridge Program students consists of four courses. Students first choose between COMS 1004 (Java) and ENGI 1006 (Python), and then choose between COMS 3134 (Java) and COMS 2132 (Python). COMS 3157 should be taken after the first two courses, and students are recommended to take COMS 3203 after completing Calculus I and at least one programming course.

1. **Introduction to Computer Science and Programming in Java (COMS W1004, 3pts):** Covers fundamental concepts of computer science, algorithmic problem-solving capabilities, and introductory Java programming skills.
or
 - **Introduction to Computation for Engineering and Applied Science (ENGI W1006, 3pts):** Introduces computational thinking, algorithmic problem solving, and Python programming with applications in science and engineering.
2. **Data Structures in Java (COMS W3134, 3pts):** Covers data types and structures; programming techniques for processing structures, storage management, and analysis of algorithms.
or
 - **Intermediate Computing in Python (COMS W2132, 4pts):** Essential data structures and algorithms in Python with practical software development skills, applications in a variety of areas including biology, natural language processing, data science, and others.
3. **Advanced Programming (COMS W3157, 4pts):** Covers practical programming techniques and tools for professional software construction, including writing code

according to specifications and documentation. Taught in C and C++ in a UNIX environment; scripting languages and basic web programming included.

4. **Discrete Mathematics (COMS W3203, 4pts):** Covers logic and proofs, mathematical induction, functions and relations, modular arithmetic, number theory, combinatorics, and graph theory.

Calculus I and up to two core courses may be waived on a case-by-case basis if taken with a B or higher grade at an accredited institution. Documentation must be provided. Waiver reviews will take place once students officially join the CS@CU MS Bridge Program.

Track Curriculum (6-7 points)

Alongside the Core, the CS@CU MS Bridge Program requires two additional track courses. Students will typically follow one of the tracks listed below.

**Course substitutions may be considered on a case-by-case basis.*

Track A

This track is for students who intend to pursue the Foundations of Computer Science, Computer Security, Network Systems, or Software Systems track in the MS program.

1. **Computer Science Theory (COMS W3261, 3pts):** Covers regular languages, context-free languages, Turing machines, Chomsky hierarchy, Church-Turing thesis, complexity theory, and NP-completeness.
2. **Fundamentals of Computer Systems (CSEE W3827, 3pts):** Covers fundamentals of computer organization and digital logic.

Track B

This track is for students who intend to pursue the Computational Biology, Machine Learning, Natural Language Processing, or Vision, Graphics, Interaction, and Robotics track in the MS program. **Two courses** should be selected from the following list based on the student's math background.

1. **Calculus III (MATH UN1201, 3pts or MATH UN1205, 3pts or APMA E2000, 4pts):** Covers vectors, vector-valued functions, functions of several variables, partial derivatives, gradients, surfaces, optimization, and the method of Lagrange multipliers.
2. **Linear Algebra and Probability (MATH UN2015, 3pts):** Covers linear algebra with a focus on probability and statistics.
3. **Computational Linear Algebra (COMS W3251, 4pts) or Linear Algebra (MATH UN2010 or APMA E3101, 3pts):** Covers linear algebra with a programming component in Python, and introduces applications of linear algebra in computer science.

4. **Calc-Based Intro to Statistics (STAT UN1201, 3pts) or Probability for Engineers (IEOR E3658, 3pts):** Covers random variables, probability distributions, pdf, cdf, mean, variance, correlation, conditional distributions, and other topics.
5. **Mathematics for Machine Learning (COMS W3770, 3pts):** Preliminary exposure to core algorithms such as linear regression, gradient descent, principal component analysis, low-rank approximations, and kernel methods.

Students who have not taken multivariable calculus should first take a course from #1. The second course can then be chosen from one of #2, #3, #4, or #5, depending on prior background in linear algebra and probability. Note that #5 (COMS W3770) requires linear algebra and recommends basic probability knowledge as prerequisites.

Students who have taken multivariable calculus should first take a course from #2 or #3 if they have not taken linear algebra. They can then take either #4 for a full course in probability and/or #5, provided they have a basic background in probability.

Scheduling your CS Bridge Curriculum

A typical CS@CU MS Bridge Program student is expected to complete the Bridge curriculum in 2 or 3 semesters. This program allows students to start in either the summer or fall semester. It is typically recommended that students begin in the summer unless they are approved to waive courses. If you are unsure, please speak with an advisor before registration. Please note that summer courses typically progress at twice the pace as fall and spring courses, and that course availability may be limited. We recommend that students take at least 2 and up to 4 Bridge courses per semester. Some example schedules are shown below.

Example Track A schedule:

Semester 1: COMS 1004, Calculus I

Semester 2: COMS 3134, COMS 3203

Semester 3: COMS 3157, COMS 3261, CSEE 3827

Example Track B schedule:

Semester 1: ENGI 1006, Calculus I

Semester 2: COMS 2132, COMS 3203

Semester 3: COMS 3157, Calculus III, Math 2015

Following successful completion of the CS@CU MS Bridge curriculum, students will seamlessly transition into the MS program coursework as described on the next page.

II. MS Program Curriculum

The Master of Science (MS) program provides a unique opportunity to develop leading-edge, in-depth knowledge of specific computer science disciplines. The department currently offers concentration tracks covering eight such disciplines.

All students must complete the following requirements:

- Complete a total of 30 points.
- Maintain at least a 2.7 overall GPA.
- Satisfy [breadth requirements](#).
- Take at least 6 points of technical courses at the 6000-level.
- Only up to 3 points of your degree can be non-CS/non-track courses. Non-CS/non-track courses must be approved by your advisor. See track webpages for more information.

Students can choose from one of the pathways below. See pathway webpages for details on requirements.

- [Computational Biology](#)
- [Computer Security](#)
- [Foundations of Computer Science](#)
- [Machine Learning](#)
- [Natural Language Processing](#)
- [Network Systems](#)
- [Software Systems](#)
- [Vision, Graphics, Interaction, and Robotics](#)
- [MS Personalized](#) (*invitation only*)
- [MS Thesis](#) (*invitation only*)