COMPUTER SCIENCE

Department Site: http://www.cs.barnard.edu
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Mission

Barnard's Computer Science department offers meaningful computing education and experiences to all Barnard students and partners with Columbia's Computer Science department to offer a major and minor in Computer Science. The department aims to expand students' use and understanding of computation and data analysis across disciplines; offer students opportunities to think critically about the social implications of technology, including how to harness it for social good; promote curricular and pedagogical advances in computer science and its multidisciplinary applications; and provide new models for engaging students and enhancing diversity in computing.

Student Learning Outcomes

Computer Science majors at Barnard study the foundations and applications of computing, as well as addressing the societal implications of computing technology. In conjunction with Columbia, a broad range of upper-level courses is available in topics including artificial intelligence, natural language processing, algorithms and complexity, cybersecurity, databases, user interfaces, and programming languages. Through these courses, students acquire the kind of flexibility needed in a rapidly changing field; they are prepared to engage in both applied and theoretical developments in computer science as they happen.

Programs of Study

The Computer Science department offers the following programs of study:

- Major in Computer Science
  - Major in Computer Science for Students Who Entered Barnard Fall 2023 or After
  - Major in Computer Science for Students Who Entered Barnard Before Fall 2023 (p. 3)
- Minor in Computer Science (p.)

For the Major in Mathematics-Computer Science, see Mathematics.

Student Advising

Advising Resources

- All Computer Science majors at Barnard are assigned a full-time faculty member from Barnard's Computer Science department as a major advisor. The major adviser can assist students in planning a program focused on personal interests while meeting major requirements.
- Students who wish to declare a special major (including Information Science or Data Science) should contact Prof. Smaranda Muresan.
- All Barnard CS majors are given an individualized CS Major Progress Check List, which is shared with their CS adviser, the CS chair, and the CS administrator.
  - Barnard CS Progress Check List
- The department regularly holds an Open House/Program Planning Meeting every semester. For more information about this and other department events, see https://cs.barnard.edu/events.

Guidance for First-Year Students

Students with no background in computer science may wish to take Introduction to Computational Thinking and Data Science COMS BC1016 and corequisite lab COMS BC1017, though it is not required.

Enrolling in Courses

- Prerequisite courses for Mathematics Requirement: MATH UN1201 (Calculus III) requires Calculus I as a prerequisite but does NOT require Calculus II. MATH UN1205 and APMA E2000, however, require both Calculus I and Calculus II as prerequisites.
- Most of our COMS BC3000-level courses have a "waitlist form" that needs to be filled out to be considered for the course, in addition to joining the waitlist. The links to the forms can be found under each course in SSOL and the Course Directory.
- COMS BC3997 New Directions in Computing is an undergraduate seminar for special topics in computing arranged as the need and availability arises. Topics are usually offered on a one-time basis, and the title of each section reflects the topic. Participation requires permission of the instructor. Since the content of this course changes each time it is offered, it may be repeated for credit with different topics.

Preparation for Graduate Study

Many Computer Science graduates step directly into career positions in computer science across industry and the public sectors, while others continue their formal education in graduate degree programs, including masters degrees and PhDs in Computer Science, as well as other pathways such as law school. The Computer Science 4+1 BA/MS Pathway is a special opportunity for students who wish to pursue an accelerated masters degree.

Computer Science 4+1 BA/MS Pathway

The Barnard/Columbia University 4+1 Pathways provide an option for students to make progress on graduate study while still an undergraduate, under the guidance of Barnard and Columbia advisors who help them develop their plans for accelerated completion of a masters degree. The Computer Science 4+1 pathway enables Barnard students to obtain a BA from Barnard and an MS from Columbia in a combined five years.

Barnard students majoring or minoring in Computer Science are eligible to apply for the Computer Science 4+1 pathway during their junior year. Accepted students will be given a Barnard Computer Science 4+1 advisor and have access to Columbia MS advisors; they can work with their Barnard and Columbia advisors to determine a study plan to enable completion of the MS in their 5th year.

For more information and application requirements, see cs.barnard.edu/4-1-computer-science.

Coursework Taken Outside of Barnard

Advanced Placement Credit

The Computer Science department does not grant any course exemptions for AP or other exam scores.

Computer Science Courses at Columbia University

Part of the School of Engineering and Applied Sciences, the Department of Computer Science at Columbia University provides many of the courses Barnard Computer Science students need to fulfill their major or

minor requirements. There is no restriction on the number of courses that may be taken at Columbia for the programs of study in Computer Science at Barnard.

Transfer Credit

- When students wish to transfer credit to Barnard from other institutions, their coursework is first evaluated for college elective credit by the Registrar's Office. If they are approved, departments can consider these courses for credit toward the major or minor.
- Transfer coursework can count in place of a major requirement if they can be deemed equivalent to a Barnard or Columbia class that counts for a requirement. They might also be countable as a COMS elective if they are a clear fit even if they are not equivalent to one of our classes, so long as you do not also take a Barnard or Columbia class that substantially overlaps with the content.
- No more than 6 transfer courses can count for the major and no more than 3 transfer courses can count for the minor.
- Computer science courses must be evaluated by Barnard's or Columbia's Computer Science department and mathematics courses must be evaluated by Barnard's Mathematics department. Please contact the department for more information.

Study Abroad Credit

- Classes taken abroad through Columbia-led programs (i.e., those administered by Columbia's Center for Global Engagement) are treated as Columbia courses, equivalent to those taken on the Morningside Heights campus.
- Classes taken abroad through other institutions or programs are treated as transfer credit and are subject to the same policies as other transfer courses. Accordingly, there will be a limit on the number of study abroad courses taken at other institutions that can be counted toward the major or minor.
- To receive credit toward the major or minor for a study abroad course (whether taken through a Columbia program or another institution/program), students must submit a Study Abroad Approval form through Slate and obtain the approval of the Chair or departmental representative.

Summer Credit

- Summer courses at Barnard are equivalent to Barnard courses taken during the academic year.
- Summer courses taken at other institutions (including Columbia) are considered transfer credit and are subject to the same policies governing other transfer courses. To receive major or minor credit for a summer course taken at another institution, students must submit a Summer Course form through Slate and have it approved by both the Registrar's Office and the Chair or department representative.

Other Important Information

The Vagelos Computational Science Center

Computer Science works in close partnership with the Vagelos Computational Science Center (CSC), Barnard's home for powerful, interdisciplinary data exploration located on the 5th Floor of the Milstein Center. The CSC aims to prepare students for the dynamic and rapidly shifting world of computational science and technology. It facilitates students' understanding of computational methods, application development, and general technological knowledge through its workshop series, public events, outreach, and projects. The CSC also serves as a resource for the greater Barnard community by providing students, researchers, faculty, and staff the tools and resources they need for the advancement of their scholarship and curricular development.

CS Help Room

Students in introductory and intermediate undergraduate courses in computer science can receive one-on-one tutoring through Barnard's Computer Science Help Room.

For hours, see cs.barnard.edu/cs-help-room.

Chair: Rebecca Wright (Druckenmiller Professor of Computer Science)

Associate Professor: Smaranda Muresan

Assistant Professors: Brian Plancher, Mark Santolucito, Lucy Simko, Corey Toler-Franklin, Tiffany Tseng

Roman Family Teaching and Research Fellow: Lisa Soros

For a list of other officers of the University offering courses in Computer Science, please see the Columbia Computer Science department website below:

https://www.cs.columbia.edu/people/faculty/

The Department of Computer Science offers a major and a minor. See below for information on:

1. The New "Trackless" Major in Computer Science for Students Who Entered Barnard Fall 2023 or After (p. 2)
2. The Old "Track-based" Major in Computer Science for Students Who Entered Barnard Before Fall 2023 (p. 3)
3. Major in Mathematics-Computer Science
4. Minor in Computer Science (p. 5)

Major in Computer Science for Students Who Entered Barnard Fall 2023 or After (p. 2):

As of Fall 2023, there is a new "trackless" version of the Computer Science curriculum. Students who joined Barnard before Fall 2023 will still follow the older, track-based CS curriculum (p. 3), though we can allow the new version as an exception.

To declare a major in Computer Science, submit a major declaration form via Slate.

The "trackless" Computer Science major consists of 14-15 courses (a minimum of 44 points) to be distributed as follows.

		Points
COMPUTER SCIENCE CORE (6 required courses)		
COMS W1004	Introduction to Computer Science and Programming in Java	3.00
COMS W3134	Data Structures in Java	3.00
COMS W3157	ADVANCED PROGRAMMING	4.00
COMS W3203	DISCRETE MATHEMATICS	4.00
COMS W3261	COMPUTER SCIENCE THEORY	3.00
CSEE W3827	FUNDAMENTALS OF COMPUTER SYSTS	3.00
MATHEMATICS REQUIREMENTS		
A. CALCULUS III / MULTIVARIABLE CALCULUS (select one of the following)		
MATH UN1201	CALCULUS III	3.00

MATH UN1205	ACCELERATED MULTIVARIABLE CALC	4.00
APMA E2000	MULTV. CALC. FOR ENGI # APP SCI	4.00
**MATH UN1201 (Calculus III) requires Calculus I as a prerequisite but does NOT require Calculus II. MATH UN1205 and APMA E2000, however, require both Calculus I and Calculus II as prerequisites.		
B. LINEAR ALGEBRA (select one of the following)		
COMS W3251	COMPUTATIONAL LINEAR ALGEBRA	4.00
APMA E3101	APPLIED MATH I: LINEAR ALGEBRA	3.00
APMA E2101	INTRO TO APPLIED MATHEMATICS	3.00
MATH UN2010	LINEAR ALGEBRA	3.00
MATH UN2015	Linear Algebra and Probability	3.00
C. PROBABILITY (select one of the following)		
STAT UN1201	CALC-BASED INTRO TO STATISTICS	3.00
STAT GU4001	INTRODUCTION TO PROBABILITY AND STATISTICS	3.00
IEOR E3658	PROBABILITY FOR ENGINEERS	3.00
MATH UN2015	Linear Algebra and Probability	3.00
** MATH UN2015 can double count for Linear Algebra and Probability requirements. This is the ONLY instance a course can double count.		
AREA FOUNDATION COURSES (AFC)		
Select 3 courses from the following list:		
COMS BC3159	Parallel Optimization for Robotics	3.00
COMS BC3160	COMPUTER GRAPHICS	3.00
COMS BC3705	NATURAL LANGUAGE PROCESSING	3.00
COMS W4111	INTRODUCTION TO DATABASES	3.00
COMS W4113	FUND-LARGE-SCALE DIST SYSTEMS	3.00
COMS W4115	PROGRAMMING LANG # TRANSLATORS	3.00
COMS W4118	OPERATING SYSTEMS I	3.00
CSEE W4119	COMPUTER NETWORKS	3.00
COMS W4152	Engineering Software-as-a-Service	3.00
COMS W4156	ADVANCED SOFTWARE ENGINEERING	3.00
COMS W4160	COMPUTER GRAPHICS	3.00
COMS W4167	COMPUTER ANIMATION	3.00
COMS W4170	USER INTERFACE DESIGN	3.00
COMS W4181	SECURITY I	3.00
CSOR W4231	ANALYSIS OF ALGORITHMS I	3.00
COMS W4236	INTRO-COMPUTATIONAL COMPLEXITY	3.00
COMS W4701	ARTIFICIAL INTELLIGENCE	3.00
COMS W4705	NATURAL LANGUAGE PROCESSING	3.00
COMS W4731	Computer Vision I: First Principles	3.00
COMS W4733	COMPUTATIONAL ASPECTS OF ROBOTICS	3.00
CBMF W4761	COMPUTATIONAL GENOMICS	3.00
COMS W4771	MACHINE LEARNING	3.00
CSEE W4824	COMPUTER ARCHITECTURE	3.00
CSEE W4868	SYSTEM-ON-CHIP PLATFORMS	3.00
COMPUTER SCIENCE ELECTIVES		
3 courses from COMS/CSXX/XXCS that are at the 3000 level or higher and are at least 3-point courses		

Major in Computer Science for Students Who Entered Barnard Before Fall 2023 (p. 3):

Students who joined Barnard before Fall 2023 follow the older, track-based CS curriculum, though students can switch to the new version with approval.

To declare a major in Computer Science, submit a major declaration form via Slate.

The tracks-based Computer Science major consists of 13-14 courses (a minimum of 41 points) to be distributed as follows.

		Points
COMPUTER SCIENCE CORE (7 required courses)		
COMS W1004	Introduction to Computer Science and Programming in Java	3.00
COMS W3134	Data Structures in Java	3.00
COMS W3157	ADVANCED PROGRAMMING	4.00
COMS W3203	DISCRETE MATHEMATICS	4.00
COMS W3261	COMPUTER SCIENCE THEORY	3.00
CSEE W3827	FUNDAMENTALS OF COMPUTER SYSTS	3.00
SELECT ONE OF THE FOLLOWING (required)		
COMS W3251	COMPUTATIONAL LINEAR ALGEBRA (RECOMMENDED)	4.00
MATH UN2010	LINEAR ALGEBRA	3.00
MATH UN2015	Linear Algebra and Probability	3.00
APMA E3101	APPLIED MATH I: LINEAR ALGEBRA	3.00
APMA E2101	INTRO TO APPLIED MATHEMATICS	3.00
STAT GU4001	INTRODUCTION TO PROBABILITY AND STATISTICS	3.00
IEOR E4150	INTRO-PROBABILITY # STATISTICS	3.00
CALCULUS REQUIREMENT (select one of the following)		
MATH UN1102	CALCULUS II	3.00
MATH UN1201	CALCULUS III (PREFERRED)	3.00
FOUNDATIONS TRACK		
TRACK REQUIRED COURSES		
CSOR W4231	ANALYSIS OF ALGORITHMS I	3.00
COMS W4236	INTRO-COMPUTATIONAL COMPLEXITY	3.00
BREADTH COURSE: any 3K or 4K COMS course not in track, 3 or more points		
TRACK ELECTIVES - 2 from:		
COMS W4203	Graph Theory	3.00
COMS W4252	INTRO-COMPUTATIONAL LEARN THRY	3.00
COMS W4261	INTRO TO CRYPTOGRAPHY	3.00
COMS E6232	ANALYSIS OF ALGORITHMS II	3.00
COMS E6261	ADVANCED CRYPTOGRAPHY	3.00
MATH UN3020	NUMBER THEORY AND CRYPTOGRAPHY	3.00
MATH UN3025	MAKING, BREAKING CODES	3.00
MATH GU4032	FOURIER ANALYSIS	3.00
MATH GU4041	INTRO MODERN ALGEBRA I	3.00
MATH GU4042	INTRO MODERN ALGEBRA II	3.00
MATH GU4061	INTRO MODERN ANALYSIS I	3.00
MATH GU4155	PROBABILITY THEORY	3.00
MATH G6238	Enumerative Combinatorics	4.50
APMA E4300	COMPUT MATH:INTRO-NUMERCL METH	3.00
CSPH G4801		3.00

CSPH G4802	Math Logic II: Incompletness	3.00
PHIL GU4431	INTRODUCTION TO SET THEORY	3.00
IEOR E4407	GAME THEOR MODELS OF OPERATION	3.00
IEOR E6608	INTEGER PROGRAMMING	3.00
IEOR E6613	Optimization, I	4.50
IEOR E6614	OPTIMIZATION II	4.50
IEOR E6711	STOCHASTIC MODELING I	4.50
IEOR E6712	STOCHASTIC MODELING II	4.50
EEOR E6616	CONVEX OPTIMIZATION	3.00
ELEN E6717	Classical and Quantum Information Theory	3.00
ELEN E6718	ERROR CORRECTING CODES	3.00
COMS W3902	UNDERGRADUATE THESIS (with adviser approval)	0.00-6.00
COMS W3998	UNDERGRAD PROJECTS IN COMPUTER SCIENCE (with adviser approval)	1.00-3.00
COMS W4901	Projects in Computer Science (with adviser approval)	1.00-3.00
COMS E6998	TOPICS IN COMPUTER SCIENCE (with adviser approval)	3.00
SOFTWARE SYSTEMS TRACK		
TRACK REQUIRED COURSES		
COMS W4115	PROGRAMMING LANG # TRANSLATORS	3.00
COMS W4118	OPERATING SYSTEMS I	3.00
COMS W4119	COMPUTER NETWORKS	3.00
BREADTH COURSE: any 3K or 4K COMS course not in track, at least 3 points		
TRACK ELECTIVE - 1 from:		
Any COMS W41xx		3.00
Any COMS W48xx		3.00
COMS W3107	Clean Object-Oriented Design	3.00
COMS BC3930	Creative Embedded Systems	3.00
COMS W4444	PROGRAMMING # PROBLEM SOLVING	3.00
COMS W3902	UNDERGRADUATE THESIS (with adviser approval)	0.00-6.00
COMS W3998	UNDERGRAD PROJECTS IN COMPUTER SCIENCE (with adviser approval)	1.00-3.00
COMS E6998	TOPICS IN COMPUTER SCIENCE (with adviser approval)	3.00
Any COMS E61xx (with adviser approval)		3.00
INTELLIGENT SYSTEMS TRACK		
TRACK REQUIRED COURSES - 2 from:		
COMS W4701	ARTIFICIAL INTELLIGENCE	3.00
COMS W4705	NATURAL LANGUAGE PROCESSING	3.00
COMS W4706	Spoken Language Processing	3.00
COMS W4731	Computer Vision I: First Principles	3.00
COMS W4733	COMPUTATIONAL ASPECTS OF ROBOTICS	3.00
COMS W4771	MACHINE LEARNING	3.00
BREADTH COURSE: any 3K or 4K COMS course not in track, at least 3 points		
TRACK ELECTIVES - 2 from:		
COMS W3902	UNDERGRADUATE THESIS (with adviser approval)	0.00-6.00
COMS W3998	UNDERGRAD PROJECTS IN COMPUTER SCIENCE (with adviser approval)	1.00-3.00
COMS W4165	COMPUT TECHNIQUES-PIXEL PROCSS	3.00
COMS W4252	INTRO-COMPUTATIONAL LEARN THRY	3.00
Any COMS W47xx		3.00
COMS W4901	Projects in Computer Science (with adviser approval; can be repeated)	1.00-3.00
COMS W4995	TOPICS IN COMPUTER SCIENCE (with adviser approval)	3.00
COMS W4996	Special topics in computer science, II (with adviser approval)	3.00
Any COMS E61xx		
COMS E6998	TOPICS IN COMPUTER SCIENCE (with adviser approval)	3.00
APPLICATIONS TRACK		
TRACK REQUIRED COURSES		
COMS W4111	INTRODUCTION TO DATABASES	3.00
COMS W4170	USER INTERFACE DESIGN	3.00
BREADTH COURSE: any 3K or 4K COMS course not in track, at least 3 points		
TRACK ELECTIVES - 2 from:		
Any COMS W41xx course		3.00
Any COMS W47xx course		3.00
COMS W3107	Clean Object-Oriented Design	3.00
COMS BC3420	PRIVACY IN A NETWORKED WORLD	4.00
COMS BC3430	Computational Sound	3.00
COMS BC3930	Creative Embedded Systems	3.00
COMS W3902	UNDERGRADUATE THESIS (with adviser approval)	0.00-6.00
COMS W4995	TOPICS IN COMPUTER SCIENCE (with adviser approval)	3.00
COMS W4996	Special topics in computer science, II (with adviser approval)	3.00
Any COMS E69xx (with adviser approval)		
VISION, GRAPHICS, INTERACTION, AND ROBOTICS TRACK		
TRACK REQUIRED COURSES - 2 from:		
COMS W4731	Computer Vision I: First Principles	3.00
COMS W4160	COMPUTER GRAPHICS	3.00
COMS W4167	COMPUTER ANIMATION	3.00
BREADTH COURSE: any 3K or 4K COMS course not in track, at least 3 points		
TRACK ELECTIVES - 2 from:		
COMS W4162	Advanced Computer Graphics	3.00
COMS W4165	COMPUT TECHNIQUES-PIXEL PROCSS	3.00
COMS W4167	COMPUTER ANIMATION	3.00
COMS W4170	USER INTERFACE DESIGN	3.00
COMS W4172	3D UI AND AUGMENTED REALITY	3.00
COMS W4701	ARTIFICIAL INTELLIGENCE	3.00
COMS W4733	COMPUTATIONAL ASPECTS OF ROBOTICS	3.00
COMS W4735	VISUAL INTERFACES TO COMPUTERS	3.00
COMS W4771	MACHINE LEARNING	3.00
COMS W4995	TOPICS IN COMPUTER SCIENCE	3.00
COMS W3902	UNDERGRADUATE THESIS (with adviser approval)	0.00-6.00
COMS W3998	UNDERGRAD PROJECTS IN COMPUTER SCIENCE (with adviser approval)	1.00-3.00
COMS W4901	Projects in Computer Science (with adviser approval)	1.00-3.00
COMS W4995	TOPICS IN COMPUTER SCIENCE (with adviser approval)	3.00
COMS W4996	Special topics in computer science, II (with adviser approval)	3.00
Any COMS E69xx (with adviser approval)		

COMBINATION TRACK (with adviser and chair approval)
3 CS COURSES (3000-level or above, at least 3 points each)
3 COURSES FROM ANOTHER DISCIPLINE (3000-level or above, at least 3 points each)

Major in Mathematics—Computer Science

For a description of the joint Major in Mathematics—Computer Science, see Mathematics.

Minor in Computer Science

Barnard students can declare a minor only once they have all of the required courses completed or in progress, and this must be done by March 1 of the senior year. Courses for the major and minor may not overlap. (The minor department chair can request an exception to this policy for a maximum of two overlapping courses if the minor requires more than 18 credits, the major requires more than 40 credits, and the overlapping courses are explicitly required for both.)

To declare Computer Science as a minor, submit a minor declaration form via Slate.

The Computer Science minor consists of the following six courses (a minimum of 19 points):

1. COMS W1004 Introduction to Computer Science and Programming in Java (3pts)
2. COMS W3134 Data Structures in Java (3pts) or COMS W3137 HONORS DATA STRUCTURES # ALGOL (4pts)
3. COMS W3203 DISCRETE MATHEMATICS (4pts)
4. One of the following three courses: COMS W3157 ADVANCED PROGRAMMING (4pts); COMS W3261 COMPUTER SCIENCE THEORY (3pts); or CSEE W3827 FUNDAMENTALS OF COMPUTER SYSTS (3pts)
5. Any 3000-level or 4000-level COMS/CSXX/XXCS course of at least 3 points.
6. Any 3000-level or 4000-level COMS/CSXX/XXCS course of at least 3 points or one linear algebra, probability, or statistics course from the following: APMA E3101 APPLIED MATH I: LINEAR ALGEBRA, APMA E2101 INTRO TO APPLIED MATHEMATICS, MATH UN2010 LINEAR ALGEBRA, MATH UN2015 Linear Algebra and Probability, IEOR E3658 PROBABILITY FOR ENGINEERS, STAT UN1201 CALC-BASED INTRO TO STATISTICS, or STAT GU4001 INTRODUCTION TO PROBABILITY AND STATISTICS

Barnard College Computer Science Courses

COMS BC1016 Introduction to Computational Thinking and Data Science. *3.00 points*.

This course and its co-requisite lab course will introduce students to the methods and tools used in data science to obtain insights from data. Students will learn how to analyze data arising from real-world phenomena while mastering critical concepts and skills in computer programming and statistical inference. The course will involve hands-on analysis of real-world datasets, including economic data, document collections, geographical data, and social networks. The course is ideal for students looking to increase their digital literacy and expand their use and understanding of computation and data analysis across disciplines. No prior programming or college-level math background is required

Spring 2025: COMS BC1016

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 1016	001/00458	M W 11:40am - 12:55pm 140 Horace Mann Hall	Tiffany Tseng	3.00	42/40
COMS 1016	002/00459	M W 1:10pm - 2:25pm 152 Horace Mann Hall	Tiffany Tseng	3.00	43/50

Fall 2025: COMS BC1016

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 1016	001/00416	M W 11:40am - 12:55pm 323 Milbank Hall		3.00	28/28

COMS BC1017 Introduction to Computational Thinking and Data Science - Lab. *1.00 point*.

This is the co-requisite lab to COMS BC 1016 (Introduction to Computational Thinking and Data Science) This course will introduce students to the methods and tools used in data science to obtain insights from data. Students will learn how to analyze data arising from real-world phenomena while mastering critical concepts and skills in computer programming and statistical inference. The course will involve hands-on analysis of real-world datasets, including economic data, document collections, geographical data, and social networks. This class is ideal for students looking to increase their digital literacy and expand their use and understanding of computation and data analysis across disciplines. No prior programming or math background is required

Spring 2025: COMS BC1017

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 1017	001/00461	W 5:00pm - 6:30pm 516 Milstein Center	Tiffany Tseng	1.00	23/25
COMS 1017	002/00468	Th 10:00am - 11:30am 516 Milstein Center	Tiffany Tseng	1.00	25/25
COMS 1017	003/00469	Th 1:00pm - 2:30pm 516 Milstein Center	Tiffany Tseng	1.00	23/25
COMS 1017	004/00470	Th 3:00pm - 4:30pm 516 Milstein Center	Tiffany Tseng	1.00	14/25

Fall 2025: COMS BC1017

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 1017	001/00979	W 4:00pm - 5:30pm 516 Milstein Center		1.00	14/22
COMS 1017	002/00981	Th 9:40am - 11:10am 516 Milstein Center		1.00	2/22
COMS 1017	003/00982	Th 11:20am - 12:50pm 516 Milstein Center		1.00	3/22

COMS BC3099 INDEPENDENT STUDY. *1.00-4.00 points*.
Course can be taken for 1-4 points.

Independent Study. Instructor permission required

Spring 2025: COMS BC3099

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3099	001/00914		Brian Plancher	1.00-4.00	3/5
COMS 3099	002/00936		Tiffany Tseng	1.00-4.00	3/5
COMS 3099	003/00948		Lucy Simko	1.00-4.00	4/5
COMS 3099	004/00954		Smaranda Muresan	1.00-4.00	1/5
COMS 3099	005/00960		Rebecca Wright	1.00-4.00	1/5
COMS 3099	006/00962		Lucy Simko	1.00-4.00	2/5
COMS 3099	007/00966		Lisa Soros	1.00-4.00	1/5

COMS BC3159 Parallel Optimization for Robotics. *3.00 points*.
Many stages of state-of-the-art robotics pipelines rely on the solutions of underlying optimization algorithms. Unfortunately, many of these approaches rely on simplifications and conservative approximations in order to reduce their computational complexity and support online operation. At the same time, parallelism has been used to significantly increase the throughput of computationally expensive algorithms across the field of computer science. And, with the widespread adoption of parallel computing platforms such as GPUs, it is natural to consider whether these architectures can benefit robotics researchers interested in solving computationally constrained problems online. This course will provide students with an introduction to both parallel programming on CPUs and GPUs as well as optimization algorithms for robotics applications. It will then dive into the intersection of those fields through case studies of recent state-of-the-art research and culminate in a team-based final project

COMS BC3162 DEVELOPING ACCESSIBLE USER INTERFACES. *3.00 points*.
Introduction to access technology and the development of accessible systems. In this course, students build and evaluate various access technologies. Topics include: text-to-speech, speech recognition, screen readers, screen magnification, alternative input, tactile displays, and web transformation. This course teaches students the deep inner workings of today's user interface technology and serve as a guide for building the user interfaces of the future

COMS BC3364 Introduction to Contextual Design for Technology. *3 points*.
Introduces methods and tools used in Contextual Inquiry (CI) specifically the early stages of software design focused on meeting user needs. Key concepts include user research, contextual design, design thinking, ideation, iterative design, prototyping, and design documentation. Projects utilize software tools used in the industry.

COMS BC3420 PRIVACY IN A NETWORKED WORLD. *4.00 points*.
The ubiquity of computers and networks in business, government, recreation, and almost all aspects of daily life has led to a proliferation of online sensitive data: data that, if used improperly, can harm the data subjects. As a result, concern about the use, ownership, control, privacy, and accuracy of these data has become a top priority. This seminar course focuses on both the technical challenges of handling sensitive data, the privacy implications of various technologies, and the policy and legal issues facing data subjects, data owners, and data users

Spring 2025: COMS BC3420

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3420	001/00471	T 9:00am - 10:50am 119 Milstein Center	Lucy Simko	4.00	27/24

Fall 2025: COMS BC3420

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3420	001/00399	T 9:00am - 10:50am 501 Diana Center	Lucy Simko	4.00	2/32

COMS BC3430 Computational Sound. *3.00 points*.
In this course, we explore the variety of roles that computation can play in the analysis, creation, and performance of music. We start with the fundamentals of sound in the digital domain, covering issues of representation and audio synthesis. We then move through various synthesis techniques including the additive, subtractive, frequency modulation (FM), and amplitude modulation (AM) synthesis. After covering some core DSP techniques, we put these concepts into performative practice by exploring "live coding". In the space of live coding, we examine various programming language designs to understand how various domain specific languages (DSLs) support live coding. For the third module, we turn our focus to automated composition and analysis, addressing challenges in music information retrieval, generative art, and autonomous improvisation systems. All the while, we continue to develop our fluency in live coding by putting new topics to practice

COMS BC3930 Creative Embedded Systems. *3.00 points*.
Ubiquitous computing is creating new canvases and opportunities for creative ideas. This class explores the use of microprocessors, distributed sensor networks, IoT, and intermedia systems for the purposes of creative expression. The course is delivered in a mixed lecture and lab format that introduces the fundamental concepts and theory behind embedded systems as well as issues particular to their creative employment. The key objective of the course is for students to conceive of and implement creative uses of computation

COMS BC3997 NEW DIRECTIONS IN COMPUTING. *1.00-3.00 points*.
This is an undergraduate seminar for special topics in computing arranged as the need and availability arises. Topics are usually offered on a one-time basis. Participation requires permission of the instructor. Since the content of this course changes each time it is offered, it may be repeated for credit

Spring 2025: COMS BC3997

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3997	004/00573	M 2:10pm - 4:00pm 406 Barnard Hall	Lucy Simko	1.00-3.00	15/16
COMS 3997	005/00574	T Th 6:10pm - 7:25pm 324 Milbank Hall	Lisa Soros	1.00-3.00	33/35
COMS 3997	006/00575	M W 11:40am - 12:55pm 324 Milbank Hall	Smaranda Muresan	1.00-3.00	39/35

Columbia University Computer Science Courses

COMS W1001 Introduction to Information Science. *3 points*.
Lect: 3.

Basic introduction to concepts and skills in Information Sciences: human-computer interfaces, representing information digitally, organizing and searching information on the internet, principles of algorithmic problem solving, introduction to database concepts, and introduction to programming in Python.

Fall 2025: COMS W1001

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 1001	001/12789	T Th 10:10am - 11:25am Room TBA	Adam Cannon	3	42/60

COMS W1002 COMPUTING IN CONTEXT. *4.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Introduction to elementary computing concepts and Python programming with domain-specific applications. Shared CS concepts and Python programming lectures with track-specific sections. Track themes will vary but may include computing for the social sciences, computing for economics and finance, digital humanities, and more. Intended for nonmajors. Students may only receive credit for one of ENGI E1006 or COMS W1002

Fall 2025: COMS W1002

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 1002	001/12790	T Th 1:10pm - 2:25pm Room TBA	Adam Cannon, Mark Santolucito	4.00	97/300
COMS 1002	002/12791	T Th 1:10pm - 2:25pm Room TBA	Mark Santolucito	4.00	17/60
COMS 1002	003/12792	T Th 1:10pm - 2:25pm Room TBA	Mark Santolucito	4.00	18/40
COMS 1002	004/12793	T Th 1:10pm - 2:25pm Room TBA	Mark Santolucito	4.00	18/60

COMS W1003 INTRO-COMPUT SCI/PROGRAM IN C. *3.00 points*.

COMS W1004 Introduction to Computer Science and Programming in Java. *3 points*.
Lect: 3.

A general introduction to computer science for science and engineering students interested in majoring in computer science or engineering. Covers fundamental concepts of computer science, algorithmic problem-solving capabilities, and introductory Java programming skills. Assumes no prior programming background. Columbia University students may receive credit for only one of the following two courses: *1004* or *1005*.

Spring 2025: COMS W1004

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 1004	001/11948	T Th 11:40am - 12:55pm 417 International Affairs Bldg	Adam Cannon	3	108/398
COMS 1004	002/11949	T Th 1:10pm - 2:25pm 417 International Affairs Bldg	Adam Cannon	3	86/398

Fall 2025: COMS W1004

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 1004	001/12794	M W 2:40pm - 3:55pm Room TBA	Paul Blaer	3	72/320
COMS 1004	002/12795	M W 5:40pm - 6:55pm Room TBA	Paul Blaer	3	42/164

COMS W1005 Introduction to Computer Science and Programming in MATLAB. *3 points*.
CC/GS: Partial Fulfillment of Science Requirement

A general introduction to computer science concepts, algorithmic problem-solving capabilities, and programming skills in MATLAB. Assumes no prior programming background. Columbia University students may receive credit for only one of the following two courses: *W1004* or *W1005*.

COMS W1011 INTERMED COMPUTER PROGRAMMING. *3.00 points*.

COMS W1012 COMPUTING IN CONTEXT REC. *0.00 points*.

Fall 2025: COMS W1012

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 1012	001/12796	Th 7:10pm - 8:00pm Room TBA	Adam Cannon	0.00	0/40
COMS 1012	002/12797	Th 7:10pm - 8:00pm Room TBA	Adam Cannon	0.00	0/40
COMS 1012	003/12798	F 10:10am - 11:00am Room TBA	Adam Cannon	0.00	0/40
COMS 1012	004/12799	F 2:00pm - 2:50pm Room TBA	Adam Cannon	0.00	0/40
COMS 1012	005/12800	Th 7:10pm - 8:00pm Room TBA	Mark Santolucito	0.00	0/40
COMS 1012	006/12801	F 9:00am - 9:50am Room TBA	Mark Santolucito	0.00	0/40
COMS 1012	007/12802	Th 7:10pm - 8:00pm Room TBA	Mark Santolucito	0.00	0/30
COMS 1012	008/12803	F 11:00am - 11:50am Room TBA	Mark Santolucito	0.00	0/30
COMS 1012	009/12804	Th 7:10pm - 8:00pm Room TBA	Mark Santolucito	0.00	0/30
COMS 1012	010/12805	F 10:10am - 11:00am Room TBA	Mark Santolucito	0.00	0/30

COMS W1103 HONORS INTRO COMPUTER SCIENCE. *3.00 points*.

COMS W1404 EMERGING SCHOLARS PROG SEMINAR. *1.00 point*.
Pass/Fail only.

Prerequisites: Instructor's permission
Corequisites: COMS W1004,COMS W1007,COMS W1002
Peer-led weekly seminar intended for first and second year undergraduates considering a major in Computer Science. Pass/fail only. May not be used towards satisfying the major or SEAS credit requirements

Spring 2025: COMS W1404

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 1404	001/11950	F 8:40am - 9:55am 502 Northwest Corner	Adam Cannon	1.00	0/16
COMS 1404	002/11951	F 10:10am - 11:25am 502 Northwest Corner	Adam Cannon	1.00	6/16
COMS 1404	003/11952	F 11:40am - 12:55pm 502 Northwest Corner	Adam Cannon	1.00	5/16
COMS 1404	004/11953	F 1:10pm - 2:25pm 502 Northwest Corner	Adam Cannon	1.00	4/16
COMS 1404	005/11954	F 2:40pm - 3:55pm 502 Northwest Corner	Adam Cannon	1.00	5/16
COMS 1404	006/11955	F 4:10pm - 5:25pm 502 Northwest Corner	Adam Cannon	1.00	6/16
COMS 1404	007/11956	F 9:30am - 10:45am 253 Engineering Terrace	Adam Cannon	1.00	4/16
COMS 1404	008/11957	F 11:00am - 12:15pm 253 Engineering Terrace	Adam Cannon	1.00	5/16
COMS 1404	009/11958	F 12:30pm - 1:45pm 253 Engineering Terrace	Adam Cannon	1.00	3/16
COMS 1404	010/11959	F 2:00pm - 3:15pm 253 Engineering Terrace	Adam Cannon	1.00	1/16

Fall 2025: COMS W1404

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 1404	001/12806	F 8:40am - 9:55am Room TBA	Christian Murphy	1.00	0/16
COMS 1404	002/12807	F 10:10am - 11:25am Room TBA	Christian Murphy	1.00	0/16
COMS 1404	003/12808	F 11:40am - 12:55pm Room TBA	Christian Murphy	1.00	0/16
COMS 1404	004/12809	F 1:10pm - 2:25pm Room TBA	Christian Murphy	1.00	0/16
COMS 1404	005/12810	F 2:40pm - 3:55pm Room TBA	Christian Murphy	1.00	0/16
COMS 1404	006/12811	F 4:10pm - 5:25pm Room TBA	Christian Murphy	1.00	0/16
COMS 1404	007/12812	F 9:30am - 10:45am Room TBA	Christian Murphy	1.00	0/16
COMS 1404	008/12813	F 11:00am - 12:15pm Room TBA	Christian Murphy	1.00	0/16
COMS 1404	009/12814	F 12:30pm - 1:45pm Room TBA	Christian Murphy	1.00	0/16
COMS 1404	010/12815	F 2:00pm - 3:15pm Room TBA	Christian Murphy	1.00	0/16

COMS W2132 Intermediate Computing in Python. *4.00 points*.
Prerequisites: (ENGI E1006) or (COMS W1002) or equivalent prior programming background in Python.
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.

COMS W2702 AI in Context. *3.00 points*.
Prerequisites: STAT UN1201 or equivalent is strongly recommended.
An interdisciplinary introduction to the history, development and modern application of artificial intelligence in a variety of contexts. Context subjects and teaching staff will vary by semester.

Fall 2025: COMS W2702

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 2702	001/12816	T Th 11:40am - 12:55pm Room TBA	Vishal Misra, Adam Cannon	3.00	49/220

COMS W3011 INTERMED COMPUTER PROGRAMMING. *3.00 points*.

COMS W3101 PROGRAMMING LANGUAGES. *1.00 point*.
Lect: 1.

Prerequisites: Fluency in at least one programming language.
Introduction to a programming language. Each section is devoted to a specific language. Intended only for those who are already fluent in at least one programming language. Sections may meet for one hour per week for the whole term, for three hours per week for the first third of the term, or for two hours per week for the first six weeks. May be repeated for credit if different languages are involved

COMS W3102 DEVELOPMENT TECHNOLOGY. *1.00-2.00 points*.
Lect: 2. Lab: 0-2.

Prerequisites: Fluency in at least one programming language.
Introduction to software development tools and environments. Each section devoted to a specific tool or environment. One-point sections meet for two hours each week for half a semester, and two point sections include an additional two-hour lab

COMS W3107 Clean Object-Oriented Design. *3.00 points*.
Prerequisites: Intro to Computer Science/Programming in Java (COMS W1004) or instructor's permission. May not take for credit if already received credit for COMS W1007.

Prerequisites: see notes re: points COMS W1004; COMS W1004 or permission of instructor. May not take for credit if already received credit for COMS W1007
A course in designing, documenting, coding, and testing robust computer software, according to object-oriented design patterns and clean coding practices. Taught in Java.Object-oriented design principles include: use cases; CRC; UML; javadoc; patterns (adapter, builder, command, composite, decorator, facade, factory, iterator, lazy evaluation, observer, singleton, strategy, template, visitor); design by contract; loop invariants; interfaces and inheritance hierarchies; anonymous classes and null objects; graphical widgets; events and listeners; Java's Object class; generic types; reflection; timers, threads, and locks

Fall 2025: COMS W3107

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3107	001/12817	T Th 2:40pm - 3:55pm Room TBA	Christian Murphy	3.00	80/80

COMS W3123 ASSEMBLY LANG AND COMPUT LOGIC. *3.00 points*.

COMS W3132 Intermediate Computing in Python. *4.00 points*.
Prerequisites: ENGI E1006 OR COMS W1002; or equivalent Python programming experience. Intermediate interdisciplinary course in computing intended for non-CS majors.
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

COMS W3134 Data Structures in Java. *3 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (COMS W1004) or COMS W1004; Knowledge of Java
Data types and structures: arrays, stacks, singly and doubly linked lists, queues, trees, sets, and graphs. Programming techniques for processing such structures: sorting and searching, hashing, garbage collection. Storage management. Rudiments of the analysis of algorithms. Taught in Java. Note: Due to significant overlap, students may receive credit for only one of the following three courses: *COMS W3134*, *COMS W3136*, *COMS W3137*.

Spring 2025: COMS W3134

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3134	001/11962	M W 2:40pm - 3:55pm 309 Havemeyer Hall	Paul Blaer	3	224/320
COMS 3134	002/11963	M W 5:40pm - 6:55pm 501 Northwest Corner	Paul Blaer	3	167/164

Fall 2025: COMS W3134

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3134	001/12818	M W 4:10pm - 5:25pm Room TBA	Brian Borowski	3	125/164
COMS 3134	002/12819	M W 5:40pm - 6:55pm Room TBA	Brian Borowski	3	29/164

COMS W3136 ESSENTIAL DATA STRUCTURES. *4.00 points*.
Prerequisites: (COMS W1004) or (COMS W1005) or (COMS W1007) or (ENGI E1006) COMS W1005 OR COMS W1007 OR ENGI E1006 OR COMS W1004
A second programming course intended for nonmajors with at least one semester of introductory programming experience. Basic elements of programming in C and C , arraybased data structures, heaps, linked lists, C programming in UNIX environment, object-oriented programming in C , trees, graphs, generic programming, hash tables. Due to significant overlap, students may only receive credit for either COMS W3134, W3136, or W3137

Fall 2025: COMS W3136

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3136	001/12820	T Th 5:40pm - 6:55pm 451 Computer Science Bldg	Timothy Paine	4.00	40/40

COMS W3137 HONORS DATA STRUCTURES # ALGOL. *4.00 points*.
Prerequisites: (COMS W1004) or (COMS W1007) COMS W1004 OR COMS W1007
Corequisites: COMS W3203
An honors introduction to data types and structures: arrays, stacks, singly and doubly linked lists, queues, trees, sets, and graphs. Programming techniques for processing such structures: sorting and searching, hashing, garbage collection. Storage management. Design and analysis of algorithms. Taught in Java. Note: Due to significant overlap, students may receive credit for only one of the following three courses: COMS W3134, W3136, or W3137

COMS W3157 ADVANCED PROGRAMMING. *4.00 points*.
Lect: 4.

Prerequisites: (COMS W3134) or (COMS W3137) COMS W3134 OR COMS W3137
C programming language and Unix systems programming. Also covers Git, Make, TCP/IP networking basics, C fundamentals

Spring 2025: COMS W3157

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3157	001/11964	M W 4:10pm - 5:25pm 301 Uris Hall	Brian Borowski	4.00	155/175
COMS 3157	002/11965	M W 5:40pm - 6:55pm 301 Uris Hall	Brian Borowski	4.00	109/175

Fall 2025: COMS W3157

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3157	001/12821	T Th 4:10pm - 5:25pm Room TBA	Jae Lee	4.00	245/398
COMS 3157	002/12822	F 12:10pm - 2:00pm Room TBA	Jae Lee	4.00	0/60

COMS W3202 FINITE MATHEMATICS. *3.00 points*.

COMS W3203 DISCRETE MATHEMATICS. *4.00 points*.
Lect: 3.

Prerequisites: Any introductory course in computer programming.
Logic and formal proofs, sequences and summation, mathematical induction, binomial coefficients, elements of finite probability, recurrence relations, equivalence relations and partial orderings, and topics in graph theory (including isomorphism, traversability, planarity, and colorings)

Spring 2025: COMS W3203

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3203	001/13386	M W 2:40pm - 3:55pm 501 Northwest Corner	Tony Dear	4.00	145/164

Fall 2025: COMS W3203

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3203	001/12823	M W 2:40pm - 3:55pm Room TBA	Tony Dear	4.00	221/250
COMS 3203	002/12824	F 2:10pm - 4:00pm Room TBA	Tony Dear	4.00	1/60

COMS W3210 Scientific Computation. *3 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: two terms of calculus.
Introduction to computation on digital computers. Design and analysis of numerical algorithms. Numerical solution of equations, integration, recurrences, chaos, differential equations. Introduction to Monte Carlo methods. Properties of floating point arithmetic. Applications to weather prediction, computational finance, computational science, and computational engineering.

COMS W3251 COMPUTATIONAL LINEAR ALGEBRA. *4.00 points*.

Fall 2025: COMS W3251

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3251	001/12825	T Th 2:40pm - 3:55pm Room TBA	Nakul Verma	4.00	30/110

COMS W3261 COMPUTER SCIENCE THEORY. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (COMS W3203) COMS W3203; COMS W3134 AND COMS W3137 AND COMS W3136
Corequisites: COMS W3134,COMS W3136,COMS W3137
Regular languages: deterministic and non-deterministic finite automata, regular expressions. Context-free languages: context-free grammars, push-down automata. Turing machines, the Chomsky hierarchy, and the Church-Turing thesis. Introduction to Complexity Theory and NP-Completeness

Spring 2025: COMS W3261

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3261	001/11966	T Th 1:10pm - 2:25pm 833 Seeley W. Mudd Building	Josh Alman	3.00	114/120
COMS 3261	002/11967	T Th 2:40pm - 3:55pm 833 Seeley W. Mudd Building	Josh Alman	3.00	115/120

Fall 2025: COMS W3261

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3261	001/12826	T Th 8:40am - 9:55am 451 Computer Science Bldg	Toniann Pitassi	3.00	110/110
COMS 3261	002/12827	T Th 10:10am - 11:25am 451 Computer Science Bldg	Toniann Pitassi	3.00	110/110

COMS W3410 COMPUTERS AND SOCIETY. *3.00 points*.
Lect: 3.

Broader impact of computers. Social networks and privacy. Employment, intellectual property, and the media. Science and engineering ethics. Suitable for nonmajors

Fall 2025: COMS W3410

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 3410	001/12828	W 4:10pm - 6:40pm Room TBA	Ronald Baecker	3.00	60/60

COMS W3770 Mathematics for Machine Learning. *3.00 points*.
Mathematical foundations of machine learning: Linear algebra, multivariable calculus, and probability and statistics. Comprehensive review and additional treatment of relevant topics used in the analysis and design of machine learning models. Preliminary exposure to core algorithms such as linear regression, gradient descent, principal component analysis, low-rank approximations, and kernel methods

COMS W3902 UNDERGRADUATE THESIS. *0.00-6.00 points*.
Prerequisites: Agreement by a faculty member to serve as thesis adviser.
An independent theoretical or experimental investigation by an undergraduate major of an appropriate problem in computer science carried out under the supervision of a faculty member. A formal written report is mandatory and an oral presentation may also be required. May be taken over more than one term, in which case the grade is deferred until all 6 points have been completed. Consult the department for section assignment

COMS W3995 Special Topics in Computer Science. *3 points*.
Lect: 3.

Prerequisites: the instructor's permission.
Consult the department for section assignment. Special topics arranged as the need and availability arise. Topics are usually offered on a one-time basis. Since the content of this course changes each time it is offered, it may be repeated for credit.

COMS W3998 UNDERGRAD PROJECTS IN COMPUTER SCIENCE. *1.00-3.00 points*.
Prerequisites: Approval by a faculty member who agrees to supervise the work.
Independent project involving laboratory work, computer programming, analytical investigation, or engineering design. May be repeated for credit. Consult the department for section assignment

COMS W3999 FIELDWORK. *1.00-2.00 points*.
Prerequisites: Obtained internship and approval from faculty advisor
May be repeated for credit, but no more than 3 total points may be used toward the 128-credit degree requirement. Only for SEAS computer science undergraduate students who include relevant off campus work experience as part of their approved program of study. Final report and letter of evaluation may be required. May not be used as a technical or nontechnical elective or as a GTE (general technical elective). May not be taken for pass/fail credit or audited.

COMS W4111 INTRODUCTION TO DATABASES. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement
Prerequisites: COMS W3134, COMS W3136, or COMS W3137; or the instructor's permission.

Prerequisites: (COMS W3134) or (COMS W3136) or (COMS W3137) or COMS W3134 AND COMS W3136 AND COMS W3137; COMS W3134, COMS W3136, or COMS W3136; or instructor's permission
The fundamentals of database design and application development using databases: entity-relationship modeling, logical design of relational databases, relational data definition and manipulation languages, SQL, XML, query processing, physical database tuning, transaction processing, security. Programming projects are required

Spring 2025: COMS W4111

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4111	001/11968	M W 2:40pm - 3:55pm 301 Uris Hall	Kenneth Ross	3.00	181/266
COMS 4111	002/11969	F 10:10am - 12:40pm 207 Mathematics Building	Donald Ferguson	3.00	101/125
COMS 4111	V01/20241		Kenneth Ross	3.00	7/99

Fall 2025: COMS W4111

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4111	001/12829	M W 4:10pm - 5:25pm Room TBA	Kenneth Ross	3.00	106/320
COMS 4111	002/12830	F 10:10am - 12:40pm Room TBA	Donald Ferguson	3.00	60/125

COMS W4112 DATABASE SYSTEM IMPLEMENTATION. *3.00 points*.
Lect: 2.5.

Prerequisites: (COMS W4111) and COMS W4111; fluency in Java or C++. CSEE W3827 is recommended.
The principles and practice of building large-scale database management systems. Storage methods and indexing, query processing and optimization, materialized views, transaction processing and recovery, object-relational databases, parallel and distributed databases, performance considerations. Programming projects are required

COMS W4113 FUND-LARGE-SCALE DIST SYSTEMS. *3.00 points*.
Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) and (COMS W3157 or COMS W4118 or CSEE W4119) *COMS W3134*, *W3136*, or *W3137*. *COMS W3157* or good working knowledge of C and C++. *COMS W4118* or *CSEE W4119*.
Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) and (COMS W3157 or COMS W4118 or CSEE W4119) Design and implementation of large-scale distributed and cloud systems. Teaches abstractions, design and implementation techniques that enable the building of fast, scalable, fault-tolerant distributed systems. Topics include distributed communication models (e.g. sockets, remote procedure calls, distributed shared memory), distributed synchronization (clock synchronization, logical clocks, distributed mutex), distributed file systems, replication, consistency models, fault tolerance, distributed transactions, agreement and commitment, Paxos-based consensus, MapReduce infrastructures, scalable distributed databases. Combines concepts and algorithms with descriptions of real-world implementations at Google, Facebook, Yahoo, Microsoft, LinkedIn, etc

Fall 2025: COMS W4113

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4113	001/12831	F 10:10am - 12:40pm 451 Computer Science Bldg	Roxana Geambasu	3.00	94/110

COMS W4115 PROGRAMMING LANG # TRANSLATORS. *3.00 points*.
Lect: 3.

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) and (COMS W3261) and (CSEE W3827) or COMS W3134 OR COMS W3136 OR COMS W3137 OR CSEE W3827 AND COMS W3261; Or the instructor's permission
Modern programming languages and compiler design. Imperative, object-oriented, declarative, functional, and scripting languages. Language syntax, control structures, data types, procedures and parameters, binding, scope, run-time organization, and exception handling. Implementation of language translation tools including compilers and interpreters. Lexical, syntactic and semantic analysis; code generation; introduction to code optimization. Teams implement a language and its compiler

Spring 2025: COMS W4115

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4115	001/11970	M W 4:10pm - 5:25pm 833 Seeley W. Mudd Building	Ronghui Gu	3.00	70/120
COMS 4115	V01/18062		Ronghui Gu	3.00	11/99

Fall 2025: COMS W4115

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4115	001/12832	M 1:10pm - 3:40pm Room TBA	Hubertus Franke	3.00	52/110

COMS W4118 OPERATING SYSTEMS I. *3.00 points*.
Lect: 3.

Prerequisites: (CSEE W3827) and CSEE W3827; Knowledge of C and programming tools as covered in COMS COMS W3136, COMS W3157, or COMS W3101, or the instructor's permission.
Design and implementation of operating systems. Topics include process management, process synchronization and interprocess communication, memory management, virtual memory, interrupt handling, processor scheduling, device management, I/O, and file systems. Case study of the UNIX operating system. A programming project is required

Spring 2025: COMS W4118

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4118	001/11971	T Th 4:10pm - 5:25pm 309 Havemeyer Hall	Kostis Kaffes	3.00	98/160
COMS 4118	V01/18065		Kostis Kaffes	3.00	2/99

Fall 2025: COMS W4118

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4118	001/12833	T Th 4:10pm - 5:25pm Room TBA	Jason Nieh	3.00	79/160

COMS W4119 COMPUTER NETWORKS. *3.00 points*.
Prerequisites: Comfort with basic probability and programming fluency in Python, C++, Java, or Ruby.
Introduction to computer networks and the technical foundations of the internet, including applications, protocols, local area networks, algorithms for routing and congestion control, security, elementary performance evaluation. Several written and programming assignments required

COMS W4121 COMPUTER SYSTEMS FOR DATA SCIENCE. *3.00 points*.
Prerequisites: CSOR W4246 OR STAT W4203; or equivalent as approved by faculty advisor. background in Computer System Organization and good working knowledge of C/C++
Corequisites: CSOR W4246,STAT GU4203
An introduction to computer architecture and distributed systems with an emphasis on warehouse scale computing systems. Topics will include fundamental tradeoffs in computer systems, hardware and software techniques for exploiting instruction-level parallelism, data-level parallelism and task level parallelism, scheduling, caching, prefetching, network and memory architecture, latency and throughput optimizations, specialization, and an introduction to programming data center computers

COMS W4137 From Algorithmic Thinking to Development. *3.00 points*.
Algorithmic problem-solving and coding skills needed to devise solutions to interview questions for software engineering positions. Solutions are implemented in Python, Java, C, and C . Approaches include brute-force, hashing, sorting, transform-and-conquer, greedy, and dynamic programming. Focus on experimentation and team work

COMS W4152 Engineering Software-as-a-Service. *3.00 points*.
Prerequisites: COMS W3134 AND COMS W3157 AND CSEE W3827
Modern software engineering concepts and practices including topics such as Software-as-a-Service, Service-oriented Architecture, Agile Development, Behavior-driven Development, Ruby on Rails, and Dev/ops

Fall 2025: COMS W4152

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4152	001/12834	T Th 8:40am - 9:55am Room TBA	Junfeng Yang	3.00	0/120

COMS W4153 Cloud Computing. *3.00 points*.
Prerequisites: COMS W4111
Software engineering skills necessary for developing cloud computing and software-as-a-service applications, covering topics such as service-oriented architectures, message-driven applications, and platform integration. Includes theoretical study, practical application, and collaborative project work

Fall 2025: COMS W4153

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4153	001/12835	F 1:10pm - 3:40pm Room TBA	Donald Ferguson	3.00	122/164

COMS W4156 ADVANCED SOFTWARE ENGINEERING. *3.00 points*.
Lect: 3.

Prerequisites: (COMS W3157) or
Software lifecycle using frameworks, libraries and services. Major emphasis on software testing. Centers on a team project

Fall 2025: COMS W4156

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4156	001/12836	T Th 10:10am - 11:25am Room TBA	Gail Kaiser	3.00	33/120

COMS W4160 COMPUTER GRAPHICS. *3.00 points*.
Lect: 3.

Prerequisites: (COMS W3134) or (COMS W3136) or (COMS W3137)
COMS W3134 OR COMS W3136 OR COMS W3137; Strong programming background and some mathematical familiarity including linear algebra is required.
Introduction to computer graphics. Topics include 3D viewing and projections, geometric modeling using spline curves, graphics systems such as OpenGL, lighting and shading, and global illumination. Significant implementation is required: the final project involves writing an interactive 3D video game in OpenGL. Due to significant overlap in content, only one of COMS 4160 or Barnard COMS 3160BC may be taken for credit

Spring 2025: COMS W4160

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4160	001/11972	T Th 6:40pm - 7:55pm 313 Fayerweather	Hadi Fadaifard	3.00	65/75
COMS 4160	V01/20390		Hadi Fadaifard	3.00	3/99

Fall 2025: COMS W4160

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4160	001/12837	M W 10:10am - 11:25am 451 Computer Science Bldg	Silvia Sellan	3.00	35/70

COMS W4162 Advanced Computer Graphics. *3 points*.
Lect: 3.

Prerequisites: (COMS W4160) or COMS W4160
A second course in computer graphics covering more advanced topics including image and signal processing, geometric modeling with meshes, advanced image synthesis including ray tracing and global illumination, and other topics as time permits. Emphasis will be placed both on implementation of systems and important mathematical and geometric concepts such as Fourier analysis, mesh algorithms and subdivision, and Monte Carlo sampling for rendering. Note: Course will be taught every two years.

COMS W4165 COMPUT TECHNIQUES-PIXEL PROCSS. *3.00 points*.
Prerequisites: COMS W3137, COMS W3251 recommended, and a good working knowledge of UNIX and C. Intended for graduate students and advanced undergraduates.
An intensive introduction to image processing - digital filtering theory, image enhancement, image reconstruction, antialiasing, warping, and the state of the art in special effects. Topics from the basis of high-quality rendering in computer graphics and of low-level processing for computer vision, remote sensing, and medical imaging. Emphasizes computational techniques for implementing useful image-processing functions

COMS W4167 COMPUTER ANIMATION. *3.00 points*.
Lect: 3.

Prerequisites: multivariable calculus, linear algebra, C++ programming proficiency. *COMS W4156* recommended.
Theory and practice of physics-based animation algorithms, including animated clothing, hair, smoke, water, collisions, impact, and kitchen sinks. Topics covered: Integration of ordinary differential equations, formulation of physical models, treatment of discontinuities including collisions/contact, animation control, constrained Lagrangian Mechanics, friction/dissipation, continuum mechanics, finite elements, rigid bodies, thin shells, discretization of Navier-Stokes equations. General education requirement: quantitative and deductive reasoning (QUA).

Spring 2025: COMS W4167

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4167	001/11973	T Th 4:10pm - 5:25pm 451 Computer Science Bldg	Changxi Zheng	3.00	26/75

COMS W4170 USER INTERFACE DESIGN. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) COMS W3134 OR COMS W3136 OR COMS W3137
Introduction to the theory and practice of computer user interface design, emphasizing the software design of graphical user interfaces. Topics include basic interaction devices and techniques, human factors, interaction styles, dialogue design, and software infrastructure. Design and programming projects are required

Spring 2025: COMS W4170

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4170	001/11975	M W 1:10pm - 2:25pm 417 International Affairs Bldg	Lydia Chilton	3.00	412/398
COMS 4170	002/18894	M 7:00pm - 9:30pm 428 Pupin Laboratories	Lydia Chilton	3.00	149/147
COMS 4170	V01/18066		Lydia Chilton	3.00	15/20

Fall 2025: COMS W4170

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4170	001/12838	T Th 11:40am - 12:55pm Room TBA	Brian Smith	3.00	0/120

COMS W4172 3D UI AND AUGMENTED REALITY. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (COMS W4160) or (COMS W4170) or COMS W4160 OR COMS W4170; Or instructor's permission
Design, development, and evaluation of 3D user interfaces. Interaction techniques and metaphors, from desktop to immersive. Selection and manipulation. Travel and navigation. Symbolic, menu, gestural, and multimodal interaction. Dialogue design. 3D software support. 3D interaction devices and displays. Virtual and augmented reality. Tangible user interfaces. Review of relevant 3D math

Spring 2025: COMS W4172

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4172	001/11976	T Th 1:10pm - 2:25pm 227 Seeley W. Mudd Building	Steven Feiner	3.00	37/45

COMS W4181 SECURITY I. *3.00 points*.
Not offered during 2023-2024 academic year.

Prerequisites: COMS W3157; or equivalent.
Introduction to security. Threat models. Operating system security features. Vulnerabilities and tools. Firewalls, virtual private networks, viruses. Mobile and app security. Usable security. Note: May not earn credit for both W4181 and W4180 or W4187

COMS W4182 SECURITY II. *3.00 points*.
Not offered during 2023-2024 academic year.

Prerequisites: COMS W4118 AND COMS W4181 AND CSEE W4119
Advanced security. Centralized, distributed, and cloud system security. Cryptographic protocol design choices. Hardware and software security techniques. Security testing and fuzzing. Blockchain. Human security issues. Note: May not earn credit for both W4182 and W4180 or W4187

Spring 2025: COMS W4182

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4182	001/11977	F 1:10pm - 3:40pm 1024 Seeley W. Mudd Building	John Koh	3.00	19/40
COMS 4182	V01/18068		John Koh	3.00	0/99

COMS W4186 MALWARE ANALYSIS#REVERSE ENGINEERING. *3.00 points*.
Not offered during 2023-2024 academic year.

Prerequisites: COMS W3157 AND CSEE W3827; or equivalent.
Hands-on analysis of malware. How hackers package and hide malware and viruses to evade analysis. Disassemblers, debuggers, and other tools for reverse engineering. Deep study of Windows Internals and x86 assembly.

$100 Lab Fee.

Fall 2025: COMS W4186

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4186	001/14310	Th 4:10pm - 6:40pm Room TBA	Michael Sikorski	3.00	3/40

COMS W4203 Graph Theory. *3 points*.
Lect: 3.

Prerequisites: (COMS W3203) COMS W3203
General introduction to graph theory. Isomorphism testing, algebraic specification, symmetries, spanning trees, traversability, planarity, drawings on higher-order surfaces, colorings, extremal graphs, random graphs, graphical measurement, directed graphs, Burnside-Polya counting, voltage graph theory.

COMS W4205 Combinatorial Theory. *3 points*.
Lect: 3.**Not offered during 2023-2024 academic year.**

Prerequisites: (COMS W3203) and course in calculus.
Sequences and recursions, calculus of finite differences and sums, elementary number theory, permutation group structures, binomial coefficients, Stilling numbers, harmonic numbers, generating functions.

COMS W4223 Networks, Crowds, and the Web. *3.00 points*.
Prerequisites: Familiarity with elementary concepts of probability and data structures or experience programming with data
Introduces fundamental ideas and algorithms on networks of information collected by online services. It covers properties pervasive in large networks, dynamics of individuals that lead to large collective phenomena, mechanisms underlying the web economy, and results and tools informing societal impact of algorithms on privacy, polarization and discrimination

Spring 2025: COMS W4223

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4223	001/14256	T Th 4:10pm - 5:25pm 313 Fayerweather	Augustin Chaintreau	3.00	66/78
COMS 4223	V01/18841		Augustin Chaintreau	3.00	32/99

Fall 2025: COMS W4223

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4223	001/12839	T Th 4:10pm - 5:25pm 451 Computer Science Bldg	Augustin Chaintreau	3.00	40/80

COMS W4231 ANALYSIS OF ALGORITHMS I. *3.00 points*.

COMS W4232 Advanced Algorithms. *3.00 points*.
Prerequisite: Analysis of Algorithms (COMS W4231).

Prerequisites: see notes re: points COMS W4231
Introduces classic and modern algorithmic ideas that are central to many areas of Computer Science. The focus is on most powerful paradigms and techniques of how to design algorithms, and how to measure their efficiency. The intent is to be broad, covering a diversity of algorithmic techniques, rather than be deep. The covered topics have all been implemented and are widely used in industry. Topics include: hashing, sketching/streaming, nearest neighbor search, graph algorithms, spectral graph theory, linear programming, models for large-scale computation, and other related topics

Spring 2025: COMS W4232

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4232	001/11978	T Th 2:40pm - 4:00pm 702 Hamilton Hall	Alexandr Andoni	3.00	35/80
COMS 4232	V01/18070		Alexandr Andoni	3.00	1/99

COMS W4236 INTRO-COMPUTATIONAL COMPLEXITY. *3.00 points*.
Lect: 3.

Prerequisites: (COMS W3261) COMS W3261
Develops a quantitative theory of the computational difficulty of problems in terms of the resources (e.g. time, space) needed to solve them. Classification of problems into complexity classes, reductions, and completeness. Power and limitations of different modes of computation such as nondeterminism, randomization, interaction, and parallelism

Fall 2025: COMS W4236

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4236	002/12840	M W 10:10am - 11:25am Room TBA	Xi Chen	3.00	16/50

COMS W4241 Numerical Algorithms and Complexity. *3 points*.
Lect: 3.

Prerequisites: knowledge of a programming language. Some knowledge of scientific computation is desirable.
Modern theory and practice of computation on digital computers. Introduction to concepts of computational complexity. Design and analysis of numerical algorithms. Applications to computational finance, computational science, and computational engineering.

COMS W4242 NUMRCL ALGORTHMS-COMPLEXITY II. *3.00 points*.

COMS W4252 INTRO-COMPUTATIONAL LEARN THRY. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (CSOR W4231) or (COMS W4236) or CSOR W4231 OR COMS W4236 OR COMS W3203 OR COMS W3261
Possibilities and limitations of performing learning by computational agents. Topics include computational models of learning, polynomial time learnability, learning from examples and learning from queries to oracles. Computational and statistical limitations of learning. Applications to Boolean functions, geometric functions, automata.

Fall 2025: COMS W4252

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4252	001/12841	T Th 11:40am - 12:55pm Room TBA	Rocco Servedio	3.00	34/86

COMS W4261 INTRO TO CRYPTOGRAPHY. *3.00 points*.
Lect: 2.5.

Prerequisites: COMS W3261 OR CSOR W4231; Comfort with basic discrete math and probability. Recommended: COMS W3261 or CSOR W4231.
An introduction to modern cryptography, focusing on the complexity-theoretic foundations of secure computation and communication in adversarial environments; a rigorous approach, based on precise definitions and provably secure protocols. Topics include private and public key encryption schemes, digital signatures, authentication, pseudorandom generators and functions, one-way functions, trapdoor functions, number theory and computational hardness, identification and zero knowledge protocols

Spring 2025: COMS W4261

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4261	001/13820	M 7:00pm - 9:30pm 451 Computer Science Bldg	Allison Bishop	3.00	86/110

Fall 2025: COMS W4261

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4261	001/12842	T Th 2:40pm - 3:55pm Room TBA	Tal Malkin	3.00	1/105

COMS W4281 INTRO TO QUANTUM COMPUTING. *3.00 points*.
Lect: 3.

Prerequisites: knowledge of linear algebra. Prior knowledge of quantum mechanics is not required, although it is helpful.
Introduction to quantum computing. Shor's factoring algorithm, Grover's database search algorithm, the quantum summation algorithm. Relationship between classical and quantum computing. Potential power of quantum computers.

Fall 2025: COMS W4281

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4281	001/12843	T Th 10:10am - 11:25am Room TBA	Henry Yuen	3.00	0/100

COMS W4295 Topics in Theoretical Computer Science. *3.00 points*.
Selected topics in theoretical computer science. Content and prerequisites vary between sections and semesters. May be repeated for credit. Check "topics courses" webpage on the department website for more information on each section

COMS W4419 INTERNET TECHNOLOGY,ECONOMICS,AND POLICY. *3.00 points*.
Not offered during 2023-2024 academic year.

Technology, economic and policy aspects of the Internet. Summarizes how the Internet works technically, including protocols, standards, radio spectrum, global infrastructure and interconnection. Micro-economics with a focus on media and telecommunication economic concerns, including competition and monopolies, platforms, and behavioral economics. US constitution, freedom of speech, administrative procedures act and regulatory process, universal service, role of FCC. Not a substitute for CSEE4119. Suitable for non-majors. May not be used as a track elective for the computer science major.

Spring 2025: COMS W4419

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4419	001/11979	M W 4:10pm - 5:25pm 829 Seeley W. Mudd Building	Henning Schulzrinne	3.00	33/40

COMS W4444 PROGRAMMING # PROBLEM SOLVING. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) and (CSEE W3827) COMS W3134 AND COMS W3136 OR COMS W3137 AND CSEE W3827
Hands-on introduction to solving open-ended computational problems. Emphasis on creativity, cooperation, and collaboration. Projects spanning a variety of areas within computer science, typically requiring the development of computer programs. Generalization of solutions to broader problems, and specialization of complex problems to make them manageable. Team-oriented projects, student presentations, and in-class participation required

Fall 2025: COMS W4444

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4444	001/12844	M W 1:10pm - 2:25pm Room TBA	Kenneth Ross	3.00	1/34

COMS W4460 PRIN-INNOVATN/ENTREPRENEURSHIP. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) or COMS W3134 OR COMS W3136 OR COMS W3137; Or instructor's permission
Team project centered course focused on principles of planning, creating, and growing a technology venture. Topics include: identifying and analyzing opportunities created by technology paradigm shifts, designing innovative products, protecting intellectual property, engineering innovative business models

Spring 2025: COMS W4460

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4460	001/11980	M W 8:40am - 9:55am 829 Seeley W. Mudd Building	William Reinisch	3.00	41/40

Fall 2025: COMS W4460

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4460	001/12845	M W 8:40am - 9:55am 451 Computer Science Bldg	William Reinisch	3.00	0/40

COMS W4701 ARTIFICIAL INTELLIGENCE. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) and COMS W3134 OR COMS W3136 OR COMS W3137; Any course on probability
Prior knowledge of Python is recommended. Provides a broad understanding of the basic techniques for building intelligent computer systems. Topics include state-space problem representations, problem reduction and and-or graphs, game playing and heuristic search, predicate calculus, and resolution theorem proving, AI systems and languages for knowledge representation, machine learning and concept formation and other topics such as natural language processing may be included as time permits

Spring 2025: COMS W4701

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4701	001/13152	M W 4:10pm - 5:25pm 301 Pupin Laboratories	Tony Dear	3.00	206/250
COMS 4701	V01/18072		Tony Dear	3.00	8/99

Fall 2025: COMS W4701

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4701	001/12846	T Th 10:10am - 11:25am Room TBA	Ansaf Salleb-Aouissi	3.00	79/150
COMS 4701	002/12847	T Th 11:40am - 12:55pm Room TBA	Ansaf Salleb-Aouissi	3.00	137/150

COMS W4705 NATURAL LANGUAGE PROCESSING. *3.00 points*.
Lect: 3.

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) or COMS W3134 OR COMS W3136 OR COMS W3137; Or instructor's permission
Computational approaches to the analysis, understanding, and generation of natural language text at scale. Emphasis on machine learning techniques for NLP, including deep learning and large language models. Applications may include information extraction, sentiment analysis, question answering, summarization, machine translation, and conversational AI. Discussion of datasets, benchmarking and evaluation, interpretability, and ethical considerations. Due to significant overlap in content, only one of COMS 4705 or Barnard COMS 3705BC may be taken for credit

Spring 2025: COMS W4705

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4705	001/11981	M W 10:10am - 11:25am 501 Schermerhorn Hall	Daniel Bauer	3.00	165/189
COMS 4705	V01/18074		Daniel Bauer	3.00	16/99

Fall 2025: COMS W4705

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4705	001/12848	M W 2:40pm - 3:55pm Room TBA	Daniel Bauer	3.00	97/147
COMS 4705	002/12849	T Th 2:40pm - 3:55pm Room TBA	John Hewitt	3.00	50/150

COMS W4706 Spoken Language Processing. *3 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) or *COMS W3134*, *W3136*, or *W3137*; or the instructor's permission.
Computational approaches to speech generation and understanding. Topics include speech recognition and understanding, speech analysis for computational linguistics research, and speech synthesis. Speech applications including dialogue systems, data mining, summarization, and translation. Exercises involve data analysis and building a small text-to-speech system.

COMS W4721 MACHINE LEARNING FOR DATA SCI. *3.00 points*.

Spring 2025: COMS W4721

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4721	001/15963	M W 2:40pm - 3:55pm 417 International Affairs Bldg	John Paisley	3.00	129/170

COMS W4725 Knowledge representation and reasoning. *3 points*.
Lect: 3.**Not offered during 2023-2024 academic year.**

Prerequisites: (COMS W4701)
General aspects of knowledge representation (KR). The two fundamental paradigms (semantic networks and frames) and illustrative systems. Topics include hybrid systems, time, action/plans, defaults, abduction, and case-based reasoning. Throughout the course particular attention is paid to design trade-offs between language expressiveness and reasoning complexity, and issues relating to the use of KR systems in larger applications.

COMS W4731 Computer Vision I: First Principles. *3.00 points*.
Lect: 3.

Prerequisites: Fundamentals of calculus, linear algebra, and C programming. Students without any of these prerequisites are advised to contact the instructor prior to taking the course.
Introductory course in computer vision. Topics include image formation and optics, image sensing, binary images, image processing and filtering, edge extraction and boundary detection, region growing and segmentation, pattern classification methods, brightness and reflectance, shape from shading and photometric stereo, texture, binocular stereo, optical flow and motion, 2D and 3D object representation, object recognition, vision systems and applications

Fall 2025: COMS W4731

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4731	001/12850	M W 5:40pm - 6:55pm 451 Computer Science Bldg	Austin Reiter	3.00	98/99

COMS W4732 Computer Vision II: Learning. *3.00 points*.
Prerequisites: COMS W4731; Fundamentals of calculus, linear algebra, and Python programming. Students without any of these prerequisites are advised to contact the instructor prior to taking the course.
Advanced course in computer vision. Topics include convolutional networks and back-propagation, object and action recognition, self-supervised and few-shot learning, image synthesis and generative models, object tracking, vision and language, vision and audio, 3D representations, interpretability, and bias, ethics, and media deception

Spring 2025: COMS W4732

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4732	001/13738	T Th 10:10am - 11:25am 451 Computer Science Bldg	Carl Vondrick	3.00	106/100
COMS 4732	V01/18075		Carl Vondrick	3.00	31/99

COMS W4733 COMPUTATIONAL ASPECTS OF ROBOTICS. *3.00 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (COMS W3134 or COMS W3136COMS W3137) COMS W3134 OR COMS W3136 OR COMS W3137 AND COMS W3251 OR MATH UN2010 OR APMA E2101 OR APMA E3101 OR MATH UN2015 AND STAT GU4001 OR IEOR E3658 OR STAT UN1201 OR MATH UN2015 Proficiency in Python or a similar programming language.
Introduction to fundamental problems and algorithms in robotics. Topics include configuration spaces, motion and sensor models, search and sampling-based planning, state estimation, localization and mapping, perception, and learning

Fall 2025: COMS W4733

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4733	001/12851	M W 2:40pm - 3:55pm 451 Computer Science Bldg	Yunzhu Li	3.00	64/100

COMS W4735 VISUAL INTERFACES TO COMPUTERS. *3.00 points*.
Lect: 3.

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) COMS W3134 OR COMS W3136 OR COMS W3137
Visual input as data and for control of computer systems. Survey and analysis of architecture, algorithms, and underlying assumptions of commercial and research systems that recognize and interpret human gestures, analyze imagery such as fingerprint or iris patterns, generate natural language descriptions of medical or map imagery. Explores foundations in human psychophysics, cognitive science, and artificial intelligence

COMS W4737 Biometrics. *3 points*.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: a background at the sophomore level in computer science, engineering, or like discipline.
In this course. we will explore the latest advances in biometrics as well as the machine learning techniques behind them. Students will learn how these technologies work and how they are sometimes defeated. Grading will be based on homework assignments and a final project. There will be no midterm or final exam. This course shares lectures with *COMS E6737*. Students taking *COMS E6737* are required to complete additional homework problems and undertake a more rigorous final project. Students will only be allowed to earn credit for *COMS W4737* or *COMS E6737* and not both.

COMS W4762 Machine Learning for Functional Genomics. *3 points*.
Prerequisites: Proficiency in a high-level programming language (Python/R/Julia). An introductory machine learning class (such as COMS 4771 Machine Learning) will be helpful but is not required.

Prerequisites: see notes re: points Proficiency in a high level programming language Python/R/Julia. An introductory machine learning class such as COMS W4771 Machine Learning will be helpful but is not required.
This course will introduce modern probabilistic machine learning methods using applications in data analysis tasks from functional genomics, where massively-parallel sequencing is used to measure the state of cells: e.g. what genes are being expressed, what regions of DNA ("chromatin") are active ("open") or bound by specific proteins.

COMS W4771 MACHINE LEARNING. *3.00 points*.
Lect: 3.

Prerequisites: COMS W4701; Any introductory course in linear algebra and any introductory course in statistics are both required. Highly recommended: COMS W4701 or knowledge of Artificial Intelligence.
Topics from generative and discriminative machine learning including least squares methods, support vector machines, kernel methods, neural networks, Gaussian distributions, linear classification, linear regression, maximum likelihood, exponential family distributions, Bayesian networks, Bayesian inference, mixture models, the EM algorithm, graphical models and hidden Markov models. Algorithms implemented in MATLAB

Spring 2025: COMS W4771

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4771	001/11982	T Th 1:10pm - 2:25pm 451 Computer Science Bldg	Nakul Verma	3.00	67/110
COMS 4771	002/11983	T Th 2:40pm - 3:55pm 451 Computer Science Bldg	Nakul Verma	3.00	54/110
COMS 4771	V01/18077		Nakul Verma	3.00	2/99

Fall 2025: COMS W4771

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4771	001/12853	T Th 1:10pm - 2:25pm 451 Computer Science Bldg	Daniel Hsu	3.00	49/110
COMS 4771	002/12854	T Th 2:40pm - 3:55pm 451 Computer Science Bldg	Daniel Hsu	3.00	29/110

COMS W4772 ADVANCED MACHINE LEARNING. *3.00 points*.
Lect: 3.

Prerequisites: (COMS W4771) or COMS W4771; Instructor's permission; knowledge of linear algebra & introductory probability or statistics is required.
An exploration of advanced machine learning tools for perception and behavior learning. How can machines perceive, learn from, and classify human activity computationally? Topics include appearance-based models, principal and independent components analysis, dimensionality reduction, kernel methods, manifold learning, latent models, regression, classification, Bayesian methods, maximum entropy methods, real-time tracking, extended Kalman filters, time series prediction, hidden Markov models, factorial HMMS, input-output HMMs, Markov random fields, variational methods, dynamic Bayesian networks, and Gaussian/Dirichlet processes. Links to cognitive science

COMS W4773 Machine Learning Theory. *3 points*.
Prerequisites: Machine Learning (COMS W4771). Background in probability and statistics, linear algebra, and multivariate calculus. Ability to program in a high-level language, and familiarity with basic algorithm design and coding principles.

Prerequisites: see notes re: points COMS W4771
Core topics from unsupervised learning such as clustering, dimensionality reduction and density estimation will be studied in detail. Topics in clustering: k-means clustering, hierarchical clustering, spectral clustering, clustering with various forms of feedback, good initialization techniques and convergence analysis of various clustering procedures. Topics in dimensionality reduction: linear techniques such as PCA, ICA, Factor Analysis, Random Projections, non-linear techniques such as LLE, IsoMap, Laplacian Eigenmaps, tSNE, and study of embeddings of general metric spaces, what sorts of theoretical guarantees can one provide about such techniques. Miscellaneous topics: design and analysis of data structures for fast Nearest Neighbor search such as Cover Trees and LSH. Algorithms will be implemented in either Matlab or Python.

COMS W4774 Unsupervised Learning. *3.00 points*.
Prerequisites: Solid background in multivariate calculus, linear algebra, basic probability, and algorithms.

Prerequisites: see notes re: points COMS W4771; Background in probability and statistics, linear algebra, and multivariate calculus. Ability to program in a high-level language, and familiarity with basic algorithm design and coding principles
Core topics from unsupervised learning such as clustering, dimensionality reduction and density estimation will be studied in detail. Topics in clustering: k-means clustering, hierarchical clustering, spectral clustering, clustering with various forms of feedback, good initialization techniques and convergence analysis of various clustering procedures. Topics in dimensionality reduction: linear techniques such as PCA, ICA, Factor Analysis, Random Projections, non-linear techniques such as LLE, IsoMap, Laplacian Eigenmaps, tSNE, and study of embeddings of general metric spaces, what sorts of theoretical guarantees can one provide about such techniques. Miscellaneous topics: design and analysis of datastructures for fast Nearest Neighbor search such as Cover Trees and LSH. Algorithms will be implemented in either Matlab or Python

Fall 2025: COMS W4774

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4774	001/12855	T Th 1:10pm - 2:25pm Room TBA	Nakul Verma	3.00	0/110

COMS W4775 Causal Inference. *3.00 points*.
Prerequisites: Discrete Math, Calculus, Statistics (basic probability, modeling, experimental design), some programming experience.

Prerequisites: see notes re: points COMS W4771; Discrete Math, Calculus, Statistics basic probability, modeling, experimental design, Some programming experience
Causal Inference theory and applications. The theoretical topics include the 3-layer causal hierarchy, causal bayesian networks, structural learning, the identification problem and the do-calculus, linear identifiability, bounding, and counterfactual analysis. The applied part includes intersection with statistics, the empirical-data sciences (social and health), and AI and ML

Fall 2025: COMS W4775

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4775	001/13753	M W 4:10pm - 5:25pm Room TBA	Elias Bareinboim	3.00	0/50

COMS W4776 Machine Learning for Data Science. *3 points*.
Lect.: 3

Prerequisites: (STAT GU4001 or IEOR E4150) and SIEO W3600 or W4150 or equivalent.
Introduction to machine learning, emphasis on data science.
Topics include least square methods, Gaussian distributions, linear classification, linear regression, maximum likelihood, exponential family distributions, Bayesian networks, Bayesian inference, mixture models, the EM algorithm, graphical models, hidden Markov models, support vector machines kernel methods. Emphasizes methods and problems relevant to big data. Students may not receive credit for both COMS W4771 and W4776.

COMS W4824 COMPUTER ARCHITECTURE. *3.00 points*.

COMS W4835 COMPUTER ORGANIZATION II. *3.00 points*.

COMS W4901 Projects in Computer Science. *1-3 points*.
Prerequisites: Approval by a faculty member who agrees to supervise the work.
A second-level independent project involving laboratory work, computer programming, analytical investigation, or engineering design. May be repeated for credit, but not for a total of more than 3 points of degree credit. Consult the department for section assignment.

COMS W4910 CURRICULAR PRACTICAL TRAINING. *1.00 point*.

COMS W4975 Topics in Natural Language Processing. *3.00 points*.
Selected topics in Natural Language Processing. Content and prerequisites vary between sections and semesters. May be repeated for credit. Check the "topics courses" webpage on the department website for more information on each section

COMS W4995 TOPICS IN COMPUTER SCIENCE. *3.00 points*.
Lect: 3.

Selected topics in computer science. Content and prerequisites vary between sections and semesters. May be repeated for credit. Check "topics course" webpage on the department website for more information on each section

Spring 2025: COMS W4995

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4995	001/11984	M W 8:40am - 9:55am 451 Computer Science Bldg	Timothy Roughgarden	3.00	51/70
COMS 4995	002/11985	T 1:10pm - 3:40pm 829 Seeley W. Mudd Building	Gary Zamchick	3.00	41/40
COMS 4995	003/11986	Th 4:10pm - 6:40pm 829 Seeley W. Mudd Building	Christian Swinehart	3.00	36/40
COMS 4995	005/13153	F 12:10pm - 2:00pm 317 Hamilton Hall	Suman Jana	3.00	3/20
COMS 4995	006/13749	M 4:10pm - 6:40pm 825 Seeley W. Mudd Building	Elias Bareinboim	3.00	20/40
COMS 4995	008/13387	M W 2:40pm - 3:55pm 633 Seeley W. Mudd Building	Jae Lee	3.00	42/60
COMS 4995	009/13388	M W 5:40pm - 6:55pm 833 Seeley W. Mudd Building	Jae Lee	3.00	98/120
COMS 4995	010/13389	M W 2:40pm - 3:55pm 233 Seeley W. Mudd Building	Corey Toler-Franklin	3.00	7/45
COMS 4995	011/13753	T Th 2:40pm - 3:55pm 501 Schermerhorn Hall	Richard Zemel	3.00	115/140
COMS 4995	012/13758	F 1:10pm - 3:40pm 545 Seeley W. Mudd Building	Yongwhan Lim	3.00	47/54
COMS 4995	013/20415	F 1:10pm - 3:40pm 829 Seeley W. Mudd Building	Gary Zamchick	3.00	39/40
COMS 4995	030/15959	T 7:00pm - 9:30pm 413 Kent Hall	Adam Kelleher	3.00	43/71
COMS 4995	031/15960	W 7:00pm - 9:30pm 142 Uris Hall	Andrei Simion	3.00	76/95
COMS 4995	032/15961	W 7:10pm - 9:40pm 501 Northwest Corner	Vijay Pappu	3.00	81/85
COMS 4995	V08/18080		Jae Lee	3.00	3/99
COMS 4995	V09/18082		Jae Lee	3.00	2/99
COMS 4995	V11/18083		Richard Zemel	3.00	19/99
COMS 4995	V12/18078		Yongwhan Lim	3.00	3/99

Fall 2025: COMS W4995

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 4995	001/12856	T Th 2:40pm - 3:55pm Room TBA	Peter Belhumeur	3.00	61/125
COMS 4995	002/12857	T 4:10pm - 6:40pm Room TBA	Paul Blaer	3.00	0/40
COMS 4995	003/12858	T 10:10am - 12:40pm Room TBA	Daniel Rubenstein	3.00	0/30
COMS 4995	004/12859	F 10:10am - 12:40pm Room TBA	Bjarne Stroustrup	3.00	0/33
COMS 4995	005/12860	M W 1:10pm - 2:25pm 451 Computer Science Bldg	Stephen Edwards	3.00	20/70
COMS 4995	007/13183	M W 5:40pm - 6:55pm Room TBA	Hans Montero	3.00	0/120
COMS 4995	008/12861	T 1:10pm - 3:40pm Room TBA	Gary Zamchick	3.00	40/40
COMS 4995	009/12862	M 7:00pm - 9:30pm 451 Computer Science Bldg	Yongwhan Lim	3.00	42/60
COMS 4995	010/13100	F 1:10pm - 3:40pm Room TBA		3.00	0/50
COMS 4995	011/13749	M W 2:40pm - 3:55pm Room TBA	Corey Toler-Franklin	3.00	4/45

COMS W4996 Special topics in computer science, II. *3 points*.
Lect: 3.**Not offered during 2023-2024 academic year.**

Prerequisites: Instructor's permission.
A continuation of COMS W4995 when the special topic extends over two terms.

COMS W6298 Advanced Topics in Theoretical Computer Science. *3.00 points*.
Selected topics in theoretical computer science (advanced level). Content and prerequisites vary between sections and semesters. May be repeated for credit. Check "topics courses" webpage on the department website for more information on each section

COMS W6706 Advanced Spoken Language Processing. *3.00 points*.
Applications of spoken language processing, including text-to-speech and dialogue systems. Analysis of speech and text, including entrainment, empathy, personality, emotion, humor, sarcasm, deception, trust, radicalization, and charisma

Fall 2025: COMS W6706

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
COMS 6706	001/14088	T 4:10pm - 6:00pm Room TBA	Julia Hirschberg	3.00	45/70

COMS W6975 Advanced Topics in Natural Language Processing. *3.00 points*.
Selected topics in Natural Language Processing (advanced level). Content and prerequisites vary between sections and semesters. May be repeated for credit. Check the "topics courses" webpage on the department website for more information on each section