

MATHEMATICS (BA)

College of Arts and Sciences

Program Website (<http://math.cornell.edu>)

CIP: 27.0101 | HEGIS: 1701.00 | NYSED: 05718

Program Description

The mathematics major adapts to a number of purposes. It can emphasize the theoretical or the applied. It can be appropriate for professionals and nonprofessionals alike and can be broad or narrow. It can also be combined easily with serious study in another subject in the physical, biological, or social sciences by means of a double major and/or a concentration within the major.

The undergraduate coordinator (<http://math.cornell.edu/mikki-klinger>) is the main contact person for the major.

Academic Standards

- All courses must be taken for a letter grade.
- A minimum grade of C- is required unless noted otherwise.
- Second attempts to meet a minimum grade requirement for admission to the major require pre-approval.
- No course may be used to satisfy more than one requirement, including the prerequisites for admission to the major.
- At least 5 courses with a MATH prefix numbered 3000 or above and counting toward the major must appear on the student's transcript.
- MATH 4900, MATH 4980, and MATH 4997 do not count toward the major.
- MATH courses at the 5000 level do not count toward the major.
- Pre-approval is required to count a graduate course toward the algebra, analysis, or topology/geometry requirement.
- Transfer credit (<http://math.cornell.edu/transfer-credit>) may be used for admission to the major and for at most two of the courses required for the major. Cornell equivalencies must appear on the student's Cornell transcript.

Admission to the Major

To apply for admission to the major, visit math.cornell.edu/major (<http://math.cornell.edu/major>).

Admission to the major requires a semester each of linear algebra, multivariable calculus, and computer programming. The department recommends¹ MATH 2210–MATH 2220 or MATH 2230–MATH 2240.

Code	Title	Hours
Linear Algebra ²		
<i>Complete one of the following:</i>		4-5
MATH 2210	Linear Algebra (with a B- or better)	
MATH 2230	Theoretical Linear Algebra and Vector Calculus I (with a B- or better)	
MATH 2940	Linear Algebra for Engineers (with a B- or better)	
MATH 2310	Linear Algebra for Data Science (with a B+ or better)	
Multivariable Calculus		
<i>Complete one of the following with a B- or better:</i>		4-5
MATH 2220	Multivariable Calculus	

MATH 2240	Theoretical Linear Algebra and Vector Calculus II
MATH 1920	Multivariable Calculus for Engineers ³
Computer Programming	
<i>Complete one of the following with a C- or better:</i>	
CS 1110	Introduction to Computing: A Design and Development Perspective
CS 1112	Introduction to Computing: An Engineering and Science Perspective
CS 2110	Object-Oriented Programming and Data Structures
CS 2112	Object-Oriented Design and Data Structures - Honors

- ¹ Students who have taken a course in linear algebra and/or multivariable calculus during high school should consider taking MATH 2230–MATH 2240, which gives a more abstract, proof-oriented treatment of the material.
- ² Substituting a 4000-level linear algebra course is not allowed.
- ³ Placement exam (<http://math.cornell.edu/ap>) credit for MATH 1920 may be used, but only if the student's exam score is equivalent to a B- or better on their first attempt at the exam.

Double Majors

Double majors with computer science, economics, and physics are common and can be facilitated by the corresponding concentrations in Mathematics. Counting a course toward two majors (i.e., double counting) is allowed by the Math Department provided at least 5 courses with a MATH prefix numbered 3000 or above and counting toward the major appear on the student's transcript. Students should consult their other major departments for their policies on double counting.

Special Academic Options

Graduate Courses

Some exceptional undergraduates, upon completing a rigorous foundation of 4000-level MATH courses, may wish to further develop their understanding of the material in subsequent graduate courses that the Math Department offers. The core courses from the mathematics graduate program - MATH 6110, MATH 6120, MATH 6310, MATH 6320, MATH 6510, and MATH 6520 - represent a good first exposure to graduate-level mathematics. MATH 6150, MATH 6160, MATH 6210, MATH 6220, MATH 6710, and MATH 6720 cover some additional material in a manner suitable to advanced undergraduates.

Undergraduates taking graduate courses should have completed advanced undergraduate courses on the same topic with a grade of A- or better. Interested students should discuss the possibility of taking graduate courses with their faculty advisor in the Math Department prior to enrolling in the course.

Senior Thesis

A senior thesis can form a valuable part of a student's experience in the mathematics major. It is intended to allow students to conduct an in-depth investigation not possible in regular course work. The work should be independent and creative. It can involve the solution of a serious mathematics problem, or it can be an expository work, or variants of these. Conducting independent research, paying careful attention to exposition in the finished written product, and the delivery of an optional

oral presentation can have a lasting positive impact on a student's educational and professional future.

Honors Program

Honors in Mathematics is awarded to graduating math majors based on excellence in and difficulty of coursework satisfying the requirements of the math major, as well as mathematical research or the completion of a senior thesis. Honors is typically awarded competitively to 15% or less of the graduating class.

Minimum Requirements for Honors in Mathematics

- A median grade¹ of A- or better in 3000+ level coursework that satisfies the requirements for the math major.
- The majority of upper-level MATH courses must be taken at the 4000 level or above, and students must have distinguished themselves.²
- Students who have not completed the requirements for a concentration in Mathematics or Applied Mathematics are expected to be exceptional to receive honors. In addition to the above criteria, they must have done outstanding work (A or A+) in the courses counting towards the math major in their concentration. A deep mathematical component to the work in their concentration is required.

¹ Additional course work beyond what is minimally required for the major will be included when calculating the median grade.

² For example, the student has taken the honors sequences (MATH 4130-MATH 4140 and MATH 4330-MATH 4340) with grades of A- or better; or has taken graduate core classes (MATH 6110-MATH 6120, MATH 6310-MATH 6320, MATH 6510-MATH 6520) with grades of A- or better; or has written a senior thesis and has strong endorsement from their advisor; or has mostly outstanding grades (A or A+)

Program Information

- Program Mode of Delivery: In Person
- Program Location: Ithaca, NY
- Minimum Credits for Degree: 120

Program Requirements

Students must complete nine (9) courses, including at least two MATH courses at the 4000-level (or above), and typically accrue 32–36 credits.

Students wishing to count a core graduate algebra course toward the algebra requirement or a core graduate analysis course toward the analysis requirement must contact the math major director (<http://math.cornell.edu/faculty>) for prior approval.

Code	Title	Hours
Algebra (2 Courses)		
<i>Select two of the following:</i>		7-8
MATH 3320	Introduction to Number Theory	
MATH 3340	Abstract Algebra	
MATH 3360	Applicable Algebra	
MATH 4310	Linear Algebra	
MATH 4330	Honors Linear Algebra	
MATH 4340	Honors Introduction to Algebra	
MATH 4370	Computational Algebra	

MATH 4500	Matrix Groups	
Analysis (2 Courses)		
<i>Select two of the following:</i>		6-8
MATH 3110	Introduction to Analysis	
MATH 3210	Manifolds and Differential Forms	
MATH 3270	Introduction to Ordinary Differential Equations	
MATH 4130	Honors Introduction to Analysis I	
MATH 4140	Honors Introduction to Analysis II	
MATH 4180	Complex Analysis	
MATH 4200	Differential Equations and Dynamical Systems	
MATH 4210	Nonlinear Dynamics and Chaos	
MATH 4220	Applied Complex Analysis	
MATH 4250	Numerical Analysis and Differential Equations	
MATH 4260	Numerical Analysis: Linear and Nonlinear Problems	
MATH 4280	Introduction to Partial Differential Equations	
Further High-Level Mathematical Courses (5 Courses)		15-20
Complete the requirements for one concentration from the options listed below.		
Total Hours		28-36

Concentration in Mathematics

Code	Title	Hours
Upper-Level Mathematics (4 Courses)		
<i>Four MATH courses numbered 3000 or above.</i>		12-16
Must include at least one topology/geometry course from the following:		
MATH 3210	Manifolds and Differential Forms ¹	
MATH 4500	Matrix Groups ²	
MATH 4520	Classical Geometries and Modern Applications	
MATH 4530	Introduction to Topology	
MATH 4540	Introduction to Differential Geometry	
Courses Dealing with Mathematical Models (1 Course)		
<i>Select one of the following:</i>		3-4
MATH 3610	Mathematical Modeling	
Any course from another department that would satisfy a requirement for one of the concentrations. ³		
With advisor approval, any course from outside mathematics with serious mathematical content that deals with scientific matters. ⁴		
CS 2110	Object-Oriented Programming and Data Structures ⁵	
PHYS 1116	Physics I: Mechanics and Special Relativity	
PHYS 2208	Fundamentals of Physics II	
PHYS 2213	Physics II: Electromagnetism	
PHYS 2217	Physics II: Electricity and Magnetism	
Total Hours		15-20

¹ MATH 3210 is allowed for the topology/geometry requirement only if not used for the analysis requirement.

² MATH 4500 is allowed for the geometry/topology requirement only if not used for the algebra requirement.

³ For example, the CS courses that count for the computer science concentration, the ECON and ORIE courses that count for the economics concentration, etc.

⁴ Serious mathematical content includes, but is not limited to, extensive use of calculus or linear algebra. PHYS 2207 and any 1000-level physics course not listed above may not be used. AP credit may not be used.

⁵ CS 2110 is allowed for the mathematical modeling requirement only if it was not used for the computer programming prerequisite for admission to the major.

Concentration in Applied Mathematics

Code	Title	Hours
Upper-Level Mathematics (3 Courses)		
<i>Three MATH courses numbered 3000 or above.</i>		9-12
Courses Dealing with Mathematical Models (1 Course)		
<i>Select one of the following:</i>		3-4
MATH 3610	Mathematical Modeling	
Any course from another department from Group B, C, or D below.		
Any course from another department that would satisfy a requirement for one of the concentrations. ¹		
With advisor approval, any course from outside mathematics with serious mathematical content that deals with scientific matters. ²		
CS 2110	Object-Oriented Programming and Data Structures ³	
PHYS 1116	Physics I: Mechanics and Special Relativity	
PHYS 2208	Fundamentals of Physics II	
PHYS 2213	Physics II: Electromagnetism	
PHYS 2217	Physics II: Electricity and Magnetism	
Further High-Level Mathematical Courses (1 Course)		
<i>Select one of the following:</i>		3-4
A fourth MATH course numbered 3000 or above.		
A second course dealing with mathematical models, excluding CS 2110, PHYS 1116, PHYS 2208, PHYS 2213, and PHYS 2217.		
Total Hours		15-20

¹ For example, the CS courses that count for the computer science concentration, the ECON and ORIE courses that count for the economics concentration, etc.

² Serious mathematical content includes, but is not limited to, extensive use of calculus or linear algebra. PHYS 2207 and any 1000-level physics course not listed above may not be used. AP credit may not be used.

³ CS 2110 is allowed for the mathematical modeling requirement only if it was not used for the computer programming prerequisite for admission to the major.

Minimum Selection of Applied Mathematics Courses

Of the nine courses used for the major — including the algebra requirement, the analysis requirement, and the five required courses enumerated above — at least one course must be taken from three of the four groups A, B, C, D. In each group, other options may be possible with advisor approval.

Code	Title	Hours
Applied Mathematics Courses		
<i>Group A - Differential Equations</i>		
MATH 3270	Introduction to Ordinary Differential Equations	
MATH 4200	Differential Equations and Dynamical Systems	

MATH 4210	Nonlinear Dynamics and Chaos
MATH 4280	Introduction to Partial Differential Equations

Group B - Discrete Mathematics and Combinatorics

MATH 3360	Applicable Algebra
MATH 4370	Computational Algebra
MATH 4410	Introduction to Combinatorics I
MATH 4420	Introduction to Combinatorics II
CS 4820	Introduction to Analysis of Algorithms
ECON 4020	Game Theory I
ORIE 3300	Optimization I

Group C - Numerical and Computational Methods

MATH 4250	Numerical Analysis and Differential Equations
or CS 4210	Numerical Analysis and Differential Equations
MATH 4260	Numerical Analysis: Linear and Nonlinear Problems
or CS 4220	Numerical Analysis: Linear and Nonlinear Problems
CS 4620	Introduction to Computer Graphics
CS 4670	Introduction to Computer Vision
MAE 4700	Finite Element Analysis for Mechanical and Aerospace Design

Group D - Probability and Statistics

MATH 4710	Basic Probability
MATH 4720	Theory of Statistics
MATH 4740	Stochastic Processes
ECON 3130	Probability and Statistics
ECON 4130	Statistical Decision Theory
ORIE 3500	Eng Probability and Statistics: Modeling and Data Science II
STSCI 3080	Probability Models and Inference
STSCI 3100	Statistical Sampling
STSCI 4030	Linear Models with Matrices

Concentration in Computer Science

Code	Title	Hours
Upper-Level Mathematics (1 Course)		
<i>One MATH course numbered 3000 or above.</i>		3-4
Computer Science Courses with Significant Mathematical Content (3 Courses)		
<i>Select three of the following:¹</i>		9-12
CS 3220		
CS 3700	Foundations of AI Reasoning and Decision-Making	
CS 3780	Introduction to Machine Learning	
CS 4110	Programming Languages and Logics	
CS 4160	Formal Verification	
CS 4210	Numerical Analysis and Differential Equations	
CS 4220	Numerical Analysis: Linear and Nonlinear Problems	
CS 4620	Introduction to Computer Graphics	
CS 4670	Introduction to Computer Vision	
CS 4740	Natural Language Processing	
CS 4744	Computational Linguistics I	
CS 4756	Robot Learning	

CS 4775	Computational Genetics and Genomics
CS 4782	Introduction to Deep Learning
CS 4783	Mathematical Foundations of Machine Learning
CS 4787	Principles of Large-Scale Machine Learning Systems
CS 4789	Introduction to Reinforcement Learning
CS 4810	
CS 4814	Introduction to Computational Complexity
CS 4820	Introduction to Analysis of Algorithms
CS 4830	Introduction to Cryptography
CS 4850	Probability, Vectors, and Matrices in Computing
CS 4852	Networks II: Market Design
CS 4860	Applied Logic

Further High-Level Mathematical Courses (1 Course)

Select one of the following: 3-4

A second MATH course numbered 3000 or above.

A fourth CS course with significant mathematical content from the list above.

Total Hours 15-20

¹ There are also many CS graduate courses with significant mathematical content that may be used. Interested students should discuss these options with their math faculty advisor (after being admitted to the math major).

Concentration in Economics

Code	Title	Hours
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Upper-Level Mathematics (1 Course)

One MATH course numbered 3000 or above. 3-4

Economics Courses with Significant Mathematical Content (3 Courses)

Select three of the following: 9-12

ECON 3130	Probability and Statistics
or ECON 6190	Econometrics I
ECON 3140	Econometrics
or ECON 6200	Econometrics II
ECON 3810	Decision Theory I
ECON 3825	Networks II: Market Design (crosslisted)
ECON 4020	Game Theory I
ECON 4130	Statistical Decision Theory
ECON 4140	Methods and Computation in Program Evaluation
ECON 4410	Quantitative Models for the Labor Market
ECON 4620	Industrial Organization: A Computational Approach
ECON 4907	The Economics of Asymmetric Information and Contracts
ECON 6090	Microeconomic Theory I ¹
ECON 6100	Microeconomic Theory II ¹
ECON 6130	Macroeconomics I ¹
ECON 6140	Macroeconomics II ¹

Further High-Level Mathematical Courses (1 Course)

Select one of the following: 3-4

A second MATH course numbered 3000 or above.

A fourth ECON course from the list above.

One of the following Operations Research courses with significant mathematical content and dealing with material of interest in Economics:

ORIE 3300	Optimization I
ORIE 3310	Optimization II
ORIE 3741	Learning with Big Messy Data
ORIE 4350	Introduction to Game Theory
ORIE 4580	Simulation Modeling and Analysis
ORIE 4600	Introduction to Financial Engineering
ORIE 4740	Statistical Data Mining I
ORIE 5600	Financial Engineering with Stochastic Calculus I
ORIE 5610	Financial Engineering with Stochastic Calculus II

Total Hours 15-20

¹ Undergraduate enrollment in ECON graduate courses requires permission of instructor.

Concentration in Mathematical Biology

Code	Title	Hours
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Upper-Level Mathematics (2 Courses)

Two MATH courses numbered 3000 or above. 6-8

Particularly appropriate are:

MATH 4200	Differential Equations and Dynamical Systems
MATH 4710	Basic Probability

Biology Courses that Have Mathematical Content and Provide Background Necessary for Work at the Interface Between Biology and Mathematics (3 Courses)

Select three of the following: 9-12

BIOCB 3620	Dynamic Models and Data in Biology
BIOCB 4381	Biomedical Data Mining and Modeling
BIOCB 4810	Principles of Population Genetics
BIOCB 4830	Quantitative Genomics and Genetics
BIOCB 4840	Computational Genetics and Genomics
BIOCB 4910	Quantitative Approaches to Population Genetics
BIOEE 3550	Data Analysis and Visualization in Ecology and Environmental Science
BIONB 4220	Modeling Behavioral Evolution
BME 3110	Cellular Systems Biology
BME 3300	Introduction to Computational Neuroscience
NTRES 4120	Wildlife Population Analysis: Techniques and Models

Total Hours 15-20

Concentration in Mathematical Physics

Code	Title	Hours
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Upper-Level Mathematics (1 Course)

One MATH course numbered 3000 or above. 3-4

Physics Courses that Make Significant Use of Advanced Mathematics (3 Courses)

Select three of the following: 9-12

PHYS 3316	Basics of Quantum Mechanics
PHYS 3317	Applications of Quantum Mechanics
PHYS 3318	Analytical Mechanics

PHYS 3327	Advanced Electricity and Magnetism
PHYS 4230	Statistical Thermodynamics
PHYS 4443	Intermediate Quantum Mechanics
PHYS 4444	Introduction to Particle Physics
PHYS 4445	Introduction to General Relativity
PHYS 4454	Introductory Solid State Physics
PHYS 4481	Quantum Information Processing
PHYS 4488	Statistical Mechanics
AEP 4340	Fluid and Continuum Mechanics
AEP 4400	Nonlinear and Quantum Optics

Further High-Level Mathematical Courses (1 Course)

Select one of the following: 3-4

- A second MATH course numbered 3000 or above.
- A fourth Physics course from the list above.

Total Hours 15-20

Concentration in Operations Research

Code **Title** **Hours**

Upper-Level Mathematics (1 Course)

One MATH course numbered 3000 or above. 3-4

Courses in Operations Research in Which the Primary Focus Involves Mathematical Techniques (3 Courses)

Select three of the following: 10-12

ORIE 3300	Optimization I
ORIE 3310	Optimization II
ORIE 3500	Eng Probability and Statistics: Modeling and Data Science II
ORIE 3510	Stochastic Processes for Decision-Making
ORIE 3741	Learning with Big Messy Data
ORIE 4330	Discrete Models
ORIE 4350	Introduction to Game Theory
ORIE 4580	Simulation Modeling and Analysis
ORIE 4600	Introduction to Financial Engineering
ORIE 4630	Operations Research Tools for Financial Engineering
ORIE 4740	Statistical Data Mining I
ORIE 4742	Info Theory, Probabilistic Modeling, and Deep Learning with Scientific and Financial Apps
ORIE 5600	Financial Engineering with Stochastic Calculus I
ORIE 5610	Financial Engineering with Stochastic Calculus II
ORIE 5640	Statistics for Financial Engineering

Further High-Level Mathematical Courses (1 Course)

Select one of the following: 3-4

- A second MATH course numbered 3000 or above.
- A fourth ORIE course from the list above.

Total Hours 16-20

Concentration in Statistics

Code **Title** **Hours**

Upper-Level Mathematics (3 Courses)

MATH 4710	Basic Probability (no substitutions)	4
MATH 4720	Theory of Statistics (no substitutions)	4
One additional MATH course numbered 3000 or above. ¹		3-4

Courses in Other Departments with Significant Content in Statistics (2 Courses)

Select two of the following: 6-8

BIOCB 4381	Biomedical Data Mining and Modeling
BIOCB 4830	Quantitative Genomics and Genetics
CS 3700	Foundations of AI Reasoning and Decision-Making
CS 3780	Introduction to Machine Learning ²
CS 4740	Natural Language Processing
CS 4789	Introduction to Reinforcement Learning
ECON 3140	Econometrics ³
ORIE 3741	Learning with Big Messy Data
ORIE 4740	Statistical Data Mining I ²
STSCI 3100	Statistical Sampling
STSCI 3510	Stochastic Processes for Decision-Making ¹
STSCI 3740	Data Mining and Machine Learning ²
STSCI 3900	Causal Inference
STSCI 4030	Linear Models with Matrices ³
STSCI 4060	Python Programming and its Applications in Statistics
STSCI 4100	Multivariate Analysis
STSCI 4110	Categorical Data
STSCI 4140	Applied Design
STSCI 4270	Introduction to Survival Analysis and Loss Models
STSCI 4520	Statistical Computing
STSCI 4550	Applied Time Series Analysis
STSCI 4780	Bayesian Data Analysis: Principles and Practice

Total Hours 17-20

- ¹ At most one stochastic processes course (STSCI 3510/ORIE 3510 or MATH 4740) is allowed.
- ² At most one course in data mining and machine learning (CS 3780, ORIE 4740, or STSCI 3740) is allowed.
- ³ At most one regression course (ECON 3140 or STSCI 4030) is allowed.

University Graduation Requirements Requirements for All Students

In order to receive a Cornell degree, a student must satisfy academic and non-academic requirements.

Academic Requirements

A student's college determines degree requirements such as residency, number of credits, distribution of credits, and grade averages. It is the student's responsibility to be aware of the specific major, degree, distribution, college, and graduation requirements for completing their chosen program of study. See the individual requirements listed by each college or school or contact the college registrar's office (<https://registrar.cornell.edu/service-resources/college-registrar-directory>) for more information.

Non-academic Requirements

Conduct Matters. Students must satisfy any outstanding sanctions, penalties or remedies imposed or agreed to under the Student Code of Conduct (Code) or Policy 6.4. Where a formal complaint under the Code or Policy 6.4 is pending, the University will withhold awarding a degree otherwise earned until the adjudication process set forth in those

procedures is complete, including the satisfaction of any sanctions, penalties or remedies imposed.

Financial Obligations. Outstanding financial obligations will not impact the awarding of a degree otherwise earned or a student's ability to access their official transcript. However, the University may withhold issuing a diploma until any outstanding financial obligations owing to the University are satisfied.

Additional Requirements for Undergraduate Students

The University has two requirements for graduation that must be fulfilled by all undergraduate students: the swim requirement, and completion of two physical education courses. For additional information about fulfilling University Graduation Requirements, see the Physical Education website (<https://scl.cornell.edu/pe/>).

Physical Education

All undergraduate students are required to take two credits (two courses) of Physical Education prior to graduation. It is recommended they complete the two courses during their first year at Cornell. Credit in Physical Education may be earned by participating in courses offered (<https://catalog.cornell.edu/courses/pe/>) by the Department of Athletics and Physical Education and Cornell Outdoor Education, by being a registered participant on a varsity athletic team, or performing in the marching band.

Students with medical concerns should contact the Office of Student Disability Services (<http://sds.cornell.edu/>).

Swim Requirement

The Faculty Advisory Committee on Athletics and Physical Education has established a basic swimming and water safety competency requirement for all undergraduate students. Normally, the requirement is taken during the Fall Orientation process at Helen Newman Hall or Teagle Hall pools. The requirement consists of the following: jump or step feet-first into the deep end of the pool, float or tread for one minute, turn around in a full circle, swim 25 yards using any stroke(s) of choice without touching the bottom or holding on to the sides (there is no time limit) and exit from the water. Students who do not complete the swim requirement during their first year, during a PE swim class or during orientation in subsequent years, will have to pay a \$100 fee. Any student who cannot meet this requirement must register for PE 1100 Beginning Swimming as their physical education course before electives can be chosen.

If a student does not pass the swim requirement in their first Beginning Swimming PE class, then the student must take a second Beginning Swimming PE class (PE 1100 or PE 1101). Successful completion of two Beginning Swimming classes (based on attendance requirements) with the instructor's recommendation will fulfill the University's swim requirement.

Students unable to meet the swim requirement because of medical reasons should contact the Office of Student Disability Services (<http://sds.cornell.edu/>). When a waiver is granted by the Faculty Committee on Physical Education, an alternate requirement is imposed. The alternate requirement substitute is set by the Director of Physical Education.

College of Arts and Sciences Graduation Requirements

Undergraduate Degrees

Graduation Requirements for the Bachelor of Arts Degree

Credit Requirement

120 academic credits are required, 100 of which must be taken in the College of Arts & Sciences. 100 credits in Arts & Sciences is a minimum number, as is the 120 credit total. A minimum of 80 credits must be in courses for which a letter grade was received. AP, IB, CASE and A-Level credits count toward the 120 total credits but not toward the 100 A&S credits. Transfer credits for non-transfer students cannot count towards the 100 A&S credits. (See list of courses (<https://as.cornell.edu/registrar/courses-that-dont-count>) that do not count as academic credit.)

Residency Requirement

Eight full-time semesters in residence (in person) are expected to complete degree requirements with a minimum of six full-time semesters being required. External transfer students must complete a minimum of four full-time residence semesters.

First-year Writing Seminar (FWS) Requirement

Two courses are required. A 5 on either the AP English Composition or Literature exam, or a 7 on the IB HL English Literature or Language exam will count towards one of these seminars. First-year students should take an FWS during their first semester at Cornell and are required to complete two by the end of their sophomore year.

Foreign Language Requirement

A student must either pass an intermediate Cornell language course at the 2000-level or above (Option 1) or complete at least 11 credits in a single foreign language at Cornell (Option 2). AP and IB credits cannot complete this requirement, but usually indicate that a student can place into a higher level course. Note: Native speakers of a foreign language may be exempted from this requirement. For a list of language offerings and placement, see Language Study at Cornell.

Distribution Requirement

Must take a minimum of 8 courses of at least 3 credits to fulfill 10 distribution categories. How an individual course is categorized is indicated with the appropriate abbreviation in its course description. It is important to recognize that only courses with the proper designation in the catalog can be used toward fulfilling the distribution requirements in Arts and Sciences. Unless otherwise specified, variable credit courses, including independent study courses, may not be used for distribution credit.

Arts & Sciences Distribution Requirement Categories:

- Arts, Literature, and Culture (ALC-AS)
- Biological Sciences (BIO-AS)
- Ethics and the Mind (ETM-AS)
- Global Citizenship (GLC-AS)
- Historical Analysis (HST-AS)
- Physical Sciences (PHS-AS)
- Social Difference (SCD-AS)
- Social Sciences (SSC-AS)
- Statistics and Data Science (SDS-AS)
- Symbolic and Mathematical Reasoning (SMR-AS)

To review distribution requirement definitions and course lists, please visit the College of Arts and Sciences Distribution Requirement List

(<https://catalog.cornell.edu/enrollment-credit-requirements/distribution-codes/arts-sciences/>) section of this catalog.

Major Requirement

Students must complete the requirements for at least one major in A&S. See individual major listings for major requirements.

Policies on Applying Cornell and Non-Cornell Courses and Credits to Distribution Requirements

Restrictions on Applying AP/Test Credit and Courses from Other Institutions to the Distribution Requirements

- Students may not apply AP/test credit or transfer credit from another institution to the distribution requirements.
- Students who transfer to the college from another institution are under the above rules for advanced placement credit, but are eligible to have credit for post-high school course work taken during regular full-time semesters (not summer terms) at their previous institution count toward all distribution requirements. Transfer students receive a detailed credit evaluation when they are accepted for admission.

Restrictions on Applying Cornell Courses to the Distribution Requirements

- First-year writing seminars and ENGL 2860 Creative, Lyric, and Expository Writing or ENGL 2880 Expository Writing taken to satisfy a first-year writing seminar requirement may not count toward any other college or major requirement.
- Only courses with the proper designation in the Courses of Study can be used toward fulfilling the distribution requirements in Arts and Sciences.
- Students may not petition to change the category of any given course, nor may any faculty member change the category of a course for an individual student. Faculty members wishing to change the category for a course in which they are the primary instructor must petition the Educational Policy Committee for a change in category. If granted, the new category must be applied to the course as a whole and not for an individual student.

Courses That May Fulfill More Than One Requirement

- A course may fulfill more than one college requirement in any of the following situations:
- A course may be used to fulfill distribution and a major requirement (except if prohibited by one of the restrictions noted on applying AP/test credit, transfer credit, and Cornell courses to distribution requirements).
- A course may satisfy a maximum of two distribution categories. Students can only double-count distribution requirements on a maximum of two courses.
- A one-semester course in foreign literature (not language) or culture that is acceptable for certifying Option 1 in that language may also be applied to the relevant distribution requirement.
- Courses may count toward any other requirement except first-year writing seminars.

Credit Requirement

Credits and Courses

Students must earn a minimum of 120 academic credits (which may include AP/test credits). Of the 120, a minimum of 100 must be from courses taken in the College of Arts and Sciences at Cornell.

Courses that do not count toward the 120 credits required for the degree

The College of Arts and Sciences does not grant credit toward the degree for every course offered by the university. Courses in service as a teaching assistant, physical education, remedial or developmental

training, precalculus mathematics, supplemental science and mathematics, offered by the Learning Strategies Center, and English as a second language are among those for which degree credit is not awarded. Students can view the list of courses that do not count for academic credit here (<https://as.cornell.edu/registrar/courses-that-dont-count>).

Other cases in which a course may not receive credit include the following:

- A course identified as a prerequisite for a subsequent course may not be taken for credit once a student completes that subsequent course.
- A repeated course. (For more information, see "Repeating courses," below.)
- A "forbidden overlap," that is, a course with material that significantly overlaps with material in a course a student has already taken. Students should consult the list of Forbidden Overlaps for more information.

Courses that count toward the 100 required Arts and Sciences credits

May include liberal arts courses approved for study abroad during a semester or academic year of full-time study (not summer abroad study), courses taken in certain off-campus Cornell residential programs, and a maximum of three courses that majors may accept from other colleges at Cornell as fulfilling major requirements. A&S courses taken in Cornell's summer session may count towards the 100 A&S credits.

Courses that do not count toward the 100 required Arts and Sciences credits

Include credits earned in other colleges at Cornell (except in the cases specifically noted in this section), transfer credits earned in any subject at institutions other than Cornell, and advanced placement/test credits. AP/test credits count as part of the 120 credits required for the degree but not as part of the 100 Arts and Sciences credits and may not be applied to distribution requirements. AP credits are posted on the transcript. If, subsequently, a student takes the course out of which they had placed, the AP credit will be removed because of the overlap in content. Students may use up to 12 credits of college approved ROTC courses as electives counting towards the 120 degree credits.

Repeating Courses

Students occasionally need to repeat courses. Some courses, such as independent study, some music and performance courses, and specific topical seminars, in which content is significantly different, do grant credit when the course is taken more than once. For all repeated courses, both grades appear on the transcript and are included in both the term and cumulative GPA. For repeated courses that do not grant credit more than once, only one instance counts toward degree credits and requirements.

Residency Requirement

The College of Arts & Sciences is a residential community and students typically spend eight semesters of full-time study in residence to earn the B.A. degree.

The completion of a fall or spring term as a full-time registered student at Cornell counts as a semester in residence. Summer and winter terms at Cornell, study in Cornell's School of Continuing Education and at other institutions do not count as semesters of residence.

The residency requirement has two components: a minimum number of semesters in residence and a requirement to spend the last full-time semester of study in residence.

Students matriculating into the College of Arts & Sciences as first-year students must have a minimum of six semesters in residence before graduating. First-year matriculants into A&S can count up to two semesters in an approved off-campus program as semesters in residence. Approved off-campus programs include A&S approved study abroad programs, Cornell in Washington, Cornell in Rome, Cornell in Los Angeles, and the Cornell-China & Asia-Pacific Studies (CAPS) Program.

Students who transfer into the College of Arts & Sciences after matriculating in their first-year in another Cornell college (internal transfers) must have a minimum of six semesters in residence, and a minimum of two semesters in the College of Arts and Sciences before graduating. Internal transfers can count up to two semesters in an approved off-campus program as semesters in residence.

Students who transfer into Cornell from another institution (external transfers) must have a minimum of four semesters in residence, and a minimum of two semesters in the College of Arts & Sciences, before graduating. External transfers can count up to one semester in an approved off-campus program as a semester in residence.

In addition to the minimum number of semesters in residence, all students must complete their final full-time semester of study (i.e., the last semester in which at least 9 academic credits are needed to meet graduation requirements) in residence. Students who have fewer than 9 credits to complete degree requirements, and have met the minimum number of semesters residency requirement, may elect to complete their degree requirements during Cornell summer and winter terms registered as an A&S student or at another institution with approved transfer credit. Students cannot meet final degree requirements registered as an extramural student at Cornell.

Exceptions to the residence requirement are not petitionable.

Foreign Language Requirement

The faculty considers competence in a foreign language essential for an educated person. Studying a language other than one's own helps students understand the dynamics of language, our fundamental intellectual tool, and enables students to understand another culture. The sooner a student acquires this competence, the sooner it will be useful. Hence, work toward the foreign language requirement should be undertaken in the first two years. Students postponing the language requirement for junior and senior years risk not graduating on time. Courses in foreign languages and/or literature are taught in the College of Arts and Sciences by the following departments: Africana Studies and Research Center, Asian Studies, Classics, Comparative Literature, German Studies, Linguistics, Near Eastern Studies, and Romance Studies. For a list of languages and placement see Language Study at Cornell.

The language requirement may be satisfied in one of the following ways:

Option 1 (FLOPI-AS)

Passing (a) a non-introductory foreign language course of 3 or more credits at Cornell at the 2000-level or above or (b) any other non-introductory course at the 2000-level or above conducted in a foreign language at Cornell. These courses are labeled in the roster with the distribution code FLOPI-AS (Foreign Language Option 1).

OR

Option 2

Passing at least 11 credits of study in a single foreign language (taken in the appropriate sequence) at Cornell.

Any exceptions to these rules will be noted elsewhere in individual department descriptions.

Students whose speaking, reading, and writing competence in a language other than English is at the same level we would expect our entering first-year students to have in English (as shown by completing high school in that language or by special examination during their first year here at Cornell) are exempt from the college's language requirement.

Major Requirement

Most departments and programs specify certain prerequisites for admission to the major; they are found on the pages for each department and program available at Degree Programs.

Students may apply for acceptance into the major as soon as they have completed the prerequisites and are confident of their choice. This may be as early as the second semester of their first year, and must be no later than the end of the second semester of sophomore year. A student without a major at the beginning of the junior year is not making satisfactory progress toward the degree and risks not being allowed to continue in the college. Undeclared first-term juniors must file a Late Declaration of Major form with Student Services and may be placed on a leave of absence during their junior year if they have not yet declared a major.

Double Majors

Completion of one major is required for graduation. Some students choose to complete more than one major. No special permission or procedure is required; students simply become accepted into multiple majors and are assigned to an advisor in each department. All completed majors are posted on the official transcript. Students are not allowed to continue their studies past their eighth semester to complete additional majors.

Early and Delayed Graduation

Graduating Early

A student may elect to graduate early if they are able to complete all graduation requirements in fewer than eight semesters.

Students must still satisfy the college's residency requirement as part of the graduation requirements. This residency requirement requires that students who are first-year matriculants into Cornell spend a minimum of six semesters in residence, external transfers must spend a minimum of four. To request an early graduation, students must notify the A&S Registrar's Office in KG 17 Klarman Hall or at as-studentservices@cornell.edu (as-studentservices@cornell.edu?subject=Early%20Graduation%20Request).

The earliest a student can request to graduate early and officially change their graduation date is immediately following the pre-enrollment period for their anticipated final semester. The student should have pre-enrolled in the classes required to meet the graduation requirements by the requested graduation date. The student must then complete Part I in DUST and have Part II completed by their major advisor.

Graduating Late: Ninth Term Enrollment

The Bachelor of Arts degree is expected to be completed in eight terms. If degree requirements cannot be completed in eight terms, students may seek permission to continue their studies. Requests will only be granted for students who have found themselves in emergent circumstances beyond their control which have prevented them from completing the degree in eight terms. Requests cannot be made until a student's final expected graduation term and will not be reviewed and approved until

after the university drop deadline for that semester. Study beyond the eighth term is not automatically granted for the purposes of changing a major. Such requests must be discussed with a college academic advisor and require registrar approval. Requests to add an additional major or minor will not be approved for study beyond the eighth term.

If approved, students in the ninth and tenth term will be on a conditional status and will have restrictions placed on their enrollment to ensure successful completion of their degree. To request a ninth term, students must have their faculty advisor update Part II for any remaining major requirements. They will also need to submit a study plan to their college advisor listing the specific courses that will meet degree requirements for one major.

Student may elect to prorate credits if enrolling in 9 or fewer credits or take a full-time load if they desire. However, enrollment will be limited to 18 credits for the term so students can focus on their remaining required courses. In the rare case where a student may need to enroll in a tenth term to complete their degree, they will be required to prorate tuition and their enrollment will be limited to only the courses/credits needed for successful completion of one major. Additional enrollments will not be allowed.

Graduation Procedures

Application to Graduate

In the first semester of their senior year, students are prompted by Arts & Sciences Student Services to complete an online application to graduate. The application is intended to help seniors identify problems early enough in the final year to make any necessary changes in course selection to satisfy those requirements. Nonetheless, ensuring graduation requirements are fully met is the student's responsibility and any problems that are discovered, even late in the final semester, must be resolved by the student before the degree can be granted. Students are responsible for checking their DUST (https://data.arts.cornell.edu/as-stus/degree_reqts.cfm) reports and transcripts each term and alerting Student Services of any problems with their academic record. To check on their progress in the major, students should consult with their major advisors.

Degree Dates

Cornell has three official degree conferral dates in the year: December, May, and August. Students who plan to graduate in August may attend commencement ceremonies in the preceding or subsequent May. Students graduating in December are invited to a special recognition ceremony in December and may also attend Commencement the following May. All academic work must be complete by the official conferral date in order to receive a degree on that date. Incomplete academic work will result in a later conferral date.