

# DATA SCIENCE MINOR

Bowers College of Computing and Information Science

Program Website (<https://stat.cornell.edu/academics/undergraduate/data-science-minor/>)

## Program Description

Offered university wide, the minor in Data Science equips students from any major with a solid understanding of the conceptual and methodological tools of data-driven discovery. Upon completing the minor, students will be ready to leverage competencies and skills to pursue careers in various fields and professions.

## Program Requirements

The requirements to complete the minor balance the specific learning outcomes with flexibility and choice, with courses distributed across the participating colleges and disciplines, to ensure students can pragmatically complete the minor along with concurrently meeting major and distribution/elective requirements.

### To Complete the Minor

- Six courses are required in total
- One course from the core statistics category. These are restricted to those courses for which a calculus-based understanding of probability can provide understanding in concepts such as maximum likelihood estimation.
- One course from the core computer programming category. This course might be either an introductory programming course or one of a select number of more advanced courses.
- Four courses from the courses listed under the following categories:
  - Data Analysis
  - Domain Expertise
  - Big Data Ethics, Policy and Society
  - Data Communication
- For the four categories, at least one course should be from each of three different categories, while the fourth can come from any category.

### Important Information about Major/Minor Overlaps

Students may count a maximum of two courses toward both the Data Science minor and their own major's core requirements, though they may count other courses they take for the minor toward their major's elective requirements, provided their department approves.

#### 1) CS Majors:

- You may count a maximum of two courses toward both the Data Science Minor and your CS core courses, CS electives, and/or CS practicum requirements for the CS major.
- You may, however, count other courses you take for the Data Science Minor toward your CS technical electives, external specialization, major-approved and/or advisor-approved elective coursework, but only if those courses meet the requirements for that category of elective.

2) Students who are majoring in a subject that requires an introductory programming course (such as CS 1110 Introduction to Computing: A

Design and Development Perspective), must satisfy the "Core Computing" requirement with a more advanced programming course.

Given the overlap of INFO courses in the Data Science Minor and the Data Science Concentration in the Information Science Minor (<https://catalog.cornell.edu/programs/information-science-minor/>), students cannot declare both.

## Data Science Minor Courses

### Core Statistics

Code	Title	Hours
ECE 3100	Introduction to Probability and Inference for Random Signals and Systems	4
ENGRD 2700	Eng Probability and Statistics: Modeling and Data Science	4
GOVT 4019		4
MATH 4710	Basic Probability	4
MATH 4720	Statistics	4
ORIE 3500	Eng Probability and Statistics: Modeling and Data Science II	4
STSCI 3080	Probability Models and Inference	4
STSCI 3110	Applied Probability and Statistics	4
ECON 3130	Probability and Statistics	4
STSCI 2200	Statistics I	4

### Core Computing

Code	Title	Hours
AEM 2820	Introduction to Database Management Systems	3
AEM 2830	VBA for Data Analysis and Business Modeling	3
AEM 2840	Python Programming for Data Analysis and Business Modeling	3
AEM 2850	R Programming for Business Analytics and Data Visualization	3
CS 1110	Introduction to Computing: A Design and Development Perspective	4
CS 1112	Introduction to Computing: An Engineering and Science Perspective	4
CS 3220	Computational Mathematics for Computer Science	3
CS 4320	Introduction to Database Systems	3
HADM 3740	Fundamentals of Database Management and Data Analysis	3
ORIE 3120	Practical Tools for Operations Research, Machine Learning and Data Science	4
STSCI 3040	R Programming for Data Science	4
STSCI 4060	Python Programming and its Applications in Statistics	4
STSCI 4520	Statistical Computing	4

### Data Analysis

Code	Title	Hours
AEM 3275	Introduction to Machine Learning in Business	3
AEM 4120	Computational Methods for Management and Economics	3
ASTRO 3334	Data Analysis and Research Techniques in Astronomy	3
ASTRO 3340	Symbolic and Numerical Computing	4

ASTRO 4523	Modeling, Mining and Machine Learning in Astronomy	3
BEE 4310	Environmental Statistics and Learning	4
CHEME 5660	Financial Data, Markets, and Mayhem for Scientists and Engineers	3
CS 3780	Introduction to Machine Learning	4
CS 4787	Principles of Large-Scale Machine Learning Systems	4
CS 4850	Probability, Vectors, and Matrices in Computing	4
ECE 4110	Random Signals in Communications and Signal Processing	4
ECE 4200	Fundamentals of Machine Learning	4
ECE 4250	Digital Signal Processing and Statistical Inference	4
ECON 3120	Applied Econometrics	4
ENGRD 2720	Data Science for Engineers	4
HADM 4010	Data Driven Analytics	3
HADM 4750	Machine Learning for Business and Hospitality Applications	1.5
HD 2930	Introduction to Data Science for Social Scientists	3
HD 2940	Data Science for Social Scientists II	3
HD 4760	Quantitative Methods II	3
INFO 2950	Introduction to Data Science	4
INFO 2951	Introduction to Data Science with R	4
INFO 3300	Visual Data Analytics for the Web	3
INFO 3370	Studying Social Inequality Using Data Science	3
INFO 3950	Data Analytics for Information Science	3
MATH 2310	Linear Algebra for Data Science (if taken before FA24, not accepted)	4
ORIE 4580	Simulation Modeling and Analysis	4
ORIE 4740	Statistical Data Mining I	4
ORIE 4741		
ORIE 4820	Data-Driven Decision Modeling and Analysis	3
PSYCH 4750		3
PSYCH 4760	Quantitative Methods II	3
PUBPOL 3100	Multiple Regression Analysis	4
STSCI 4060	Python Programming and its Applications in Statistics	4
STSCI 4100	Multivariate Analysis	4
STSCI 4110	Categorical Data	3
STSCI 3740	Data Mining and Machine Learning	4
STSCI 4780	Bayesian Data Analysis: Principles and Practice	4
INFO 1260	Choices and Consequences in Computing	3
INFO 3200	Technology, Behavior and Society	3
INFO 3370	Studying Social Inequality Using Data Science	3
INFO 4240	Designing Technology for Social Impact	4
INFO 4250	Surveillance and Privacy	3
INFO 4270		3
INFO 4505	Computing and Global Development	3
INFO 4561	Evaluation and Society	3
NBA 4920	AI for Business Applications	1.5-3
PUBPOL 2070	Big Data for Big Policy Problems	4
PUBPOL 2130	Data and the State: How Governments See People and Places	4
PUBPOL 3520	Economic and Policy Implications of Artificial Intelligence	3
PUBPOL 4230		
PUBPOL 4540	Collaborative Modeling Methods for Policy and Program Evaluation	3
STS 3440	Data Science and Society Lab	3
STS 3561	Computing Cultures	4
STS 3940		3
STSCI 3600 & STSCI 4850	Integrated Ethics in Data Science and Data Science Consulting	2

## Data Communication

Code	Title	Hours
COGST 3420	Human Perception: Application to Computer Graphics, Art, and Visual Display	3
COMM 3010	Writing and Producing the Narrative for Digital Media	3
COMM 3150	Organizational Communication: Theory and Practice	3
COMM 3350		
COMM 3189	Taking America's Pulse: Creating and Conducting a 3-4 National Opinion Poll	
COMM 4200		
COMM 4360	Communication Networks and Social Capital	3
COMM 4860	Risk Communication	3
INFO 3312	Data Communication	3
INFO 3950	Data Analytics for Information Science	3
INFO 4310	Interactive Information Visualization	3
SOC 3580	Big Data on the Social World	3

## Domain Expertise

Code	Title	Hours
AEM 2770	Excursions in Computational Sustainability	3
AEM 3100	Business Statistics	3
AEM 4060	Risk Simulation and Monte Carlo Methods	3
AEM 4110	Introduction to Econometrics	3
AEM 4225	Systems and Analytics in Accounting	3
AEM 4435	Data Driven Marketing	1.5
AEM 4620	Digital Innovation in Media Markets & Creative Industries	3
AEM 4660	Business Simulation	1.5
ASTRO 3310	Planetary Image Processing with MATLAB	3

## Big Data Ethics, Policy & Society

Code	Title	Hours
ALS 1210	Data Democratization	3
COMM 4242		
DSOC 2120		
DSOC 4060		
ENGL 3778	Free Speech, Censorship, and the Age of Global Media	4
ENGRG 3605	Ethics of Computing and Artificial Intelligence Technologies	3
GOVT 3999	How Do You Know That?	4
INFO 1200	Information Ethics, Law, and Policy	3

BIOCB 4381	Biomedical Data Mining and Modeling	3	ORIE 4742	Info Theory, Probabilistic Modeling, and Deep Learning with Scientific and Financial Apps	3
BIOCB 4830	Quantitative Genomics and Genetics	4	PLSCS 4110		
BIOCB 4840	Computational Genetics and Genomics	4	PLSCS 4200		
BIOEE 3550	Data Analysis and Visualization in Ecology and Environmental Science	3	PLSCI 4290	Remote Sensing and Modeling for Ecosystems	3
BIOEE 3611	Field Ecology	3	PLSCS 4650		
BIOEE 3620			PUBPOL 3120	Research Design and Methods of Social Research	3
BIOEE 4940	Special Topics in Ecology and Evolutionary Biology	1-6	PUBPOL 3130	Behavioral Economics and Public Policy	3
BIOMG 4810	Population Genetics	4	PUBPOL 3280	Fundamentals of Population Health	3
BIOMG 4870	Human Genomics	3	PUBPOL 3400	The Economics of Consumer Policy	3
BIONB 3300	Introduction to Computational Neuroscience	3-4	PUBPOL 3550	Economics of Education	3
BIONB 4220	Modeling Behavioral Evolution	4	PUBPOL 3600	Economics of Crime	3
BIONB 4380	Topics in Computational Methods for Neurobiology and Behavior	3	PUBPOL 3670	Economics and Environmental Policy	3
BTRY 4820			PUBPOL 3780	Global Comparative Health Care Systems	3
CHEM 4810	Computational Methods in Chemistry	4	PUBPOL 3850		
COGST 3140	Computational Psychology	3	PUBPOL 4080	Demographic Techniques	3
CRP 4080	Introduction to Geographic Information Systems (GIS)	4	PUBPOL 4101	Causal Reasoning and Policy Evaluation I	3
CS 4300	Language and Information	3	PUBPOL 4110	Pollution, Climate Change, and Health	3
CS 4740	Natural Language Processing	4	STS 4040	Digital Due Process Clinic	4
DSOC 3140			Questions about the minor should be directed to: Julia Aquadro (jra269@cornell.edu), Assistant Director of Undergraduate Advising.		
EAS 3450	Environmental Geophysics	3			
ECON 3120	Applied Econometrics	4			
ECON 3140	Econometrics	4			
ECON 4110		3			
ECON 4660	Behavioral Economics	4			
ENTOM 3030	Applied Statistics: Biological Experiments in Practice	4			
GOVT 3282	Data Science Applications in Political and Social Research	4			
HADM 4050	Revenue Management	3			
HADM 4770	Advanced Business Modeling	2			
INFO 3140	Computational Psychology	3			
INFO 3350	Text Mining History and Literature	3			
INFO 4100	Learning Analytics	3			
IFNO 4555					
ILRHR 4664	Talent Analytics	3			
ILROB 4710	Social Science Research Methods	3			
NS 4300	Proteins, Transcripts, and Metabolism: Big Data in Molecular Nutrition	3			
NTRES 3100	Applied Population Ecology	3			
NTRES 3500					
NTRES 4100	Advanced Conservation Biology	4			
ORIE 2380		3			
ORIE 4120	Inventory, Operations, and Supply Chain Management: Models and Optimization	3			
ORIE 4126	Principles of Supply Chain Management	4			
ORIE 4132					
ORIE 4154	Revenue Optimization and Marketplace Design	3			
ORIE 4630	Operations Research Tools for Financial Engineering	4			
ORIE 4656	Extreme Values in Finance	3			