DATA SCIENCE, MINOR

Data Science applies core concepts in computer science, statistics and mathematics to problems in a wide variety of fields, from physical, social, biomedical, and behavioral sciences to arts and humanities. The minor targets students with strong analytical abilities and some existing programming experience, and requires courses in statistics, data-centric programming, data management, and data analysis. It also points to courses across the University that deal with data in areas of importance to Data Science.

SEAS Second Major or Minor Option

Students interested in a second major (College students only) or minor with SEAS are required to meet with the Undergraduate Curriculum Chair from the major/minor department you wish to declare to discuss requirements and obtain approval on the Second Major or Minor form. The approved form must be returned to the SEAS Research and Academic Services Office, 109 Towne Building.

For more information: http://www.seas.upenn.edu/undergraduate/degrees/minors.php

Data Science Minor

Code	Title	Course Units
Core Requirements		**4**
CIS 120	Programming Languages and Techniques I	
CIS 419/519	Applied Machine Learning [2]	
or STAT 471	Modern Data Mining	
or CIS 520	Machine Learning	
NETS 212	Scalable and Cloud Computing	
or CIS 545	Big Data Analytics	
ENM 321	Engineering Statistics	
or ESE 402	Statistics for Data Science	
or STAT 431	Statistical Inference	
Data Science Electives [1]		**2**
Two electives required from two of the categories below. Approval required.		
Data-Centric Programming		
CIS 105	Computational Data Exploration	
ENGR 105	Introduction to Scientific Computing	
OIDD 311	Business Computer Languages	
STAT 405	Statistical Computing with R (Cannot be taken by SEAS students)	
STAT 470	Data Analytics and Statistical Computing	
ESE 305	Foundations of Data Science	
Statistics		
EAS 205	Applications of Scientific Computing.	
CIS 261	Discrete Probability, Stochastic Processes, and Statistical Inference	
ESE 301	Engineering Probability	
BIOL 446	Statistics for Biologists	
STAT 430	Probability	
STAT 476	Applied Probability Models in Marketing	
Data Collection, Representation, Management and Retrieval		
CIS 455/555	Internet and Web Systems	
CIS 450	Database and Information Systems	
or CIS 550	Database and Information Systems	
NETS 213	Crowdsourcing and Human Computation	
OIDD 105	Developing Tools for Data Access and Analysis (VBA and SQL Programming)	
STAT 475	Sample Survey Design	
Data Analysis		
CIS 419	Applied Machine Learning	
or CIS 519	Applied Machine Learning	
CIS 421	Artificial Integlligence	
CIS 520	Machine Learning	
MKTG 212	Data and Analysis for Marketing Decisions	
MKTG 309	Special Topics: Experiments for Business Decision Making	
OIDD 410	Decision Support Systems	
STAT 422	Predictive Analytics for Business	
STAT 435	Forecasting Methods for Management	
STAT 471	Modern Data Mining	
STAT 474	Modern Regression for the Social, Behavioral and Biological Sciences	
STAT 520	Applied Econometrics I	
Modeling		
NETS 312	Theory of Networks	
MKTG 271	Models for Marketing Strategy	
OIDD 325	Computer Simulation Models	
OIDD 353	Mathematical Modeling and its Application in Finance	
STAT 433	Stochastic Processes	
STAT 436		
Total Course Units		6

1 Approval required.

2 Both CIS 419/519 and CIS 520 cannot be taken for credit toward the minor.

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2020 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.