**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](http://www.seas.upenn.edu/undergraduate/degrees/minors.php)

### Data Science Minor

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Course Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Core Requirements</strong></td>
<td></td>
</tr>
<tr>
<td>CIS 1200</td>
<td>Programming Languages and Techniques I</td>
<td>4</td>
</tr>
<tr>
<td>CIS 4190/5190</td>
<td>Applied Machine Learning</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>or STAT 4710</td>
<td>Modern Data Mining</td>
</tr>
<tr>
<td></td>
<td>or CIS 5200</td>
<td>Machine Learning</td>
</tr>
<tr>
<td>NETS 2120</td>
<td>Scalable and Cloud Computing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or CIS 5450</td>
<td>Big Data Analytics</td>
</tr>
<tr>
<td>ENM 3210</td>
<td>or ESE 4020</td>
<td>Statistics for Data Science</td>
</tr>
<tr>
<td></td>
<td>or STAT 4310</td>
<td>Statistical Inference</td>
</tr>
<tr>
<td></td>
<td><strong>Data Science Electives</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Two electives required from two of the categories below. Approval required.</td>
<td></td>
</tr>
</tbody>
</table>

Data-Centric Programming

- CIS 1050 | Computational Data Exploration
- ENGR 1050 | Introduction to Scientific Computing
- OIDD 3110 | Business Computer Languages
- STAT 4050 | Statistical Computing with R (Cannot be taken by SEAS students)
- STAT 4700 | Data Analytics and Statistical Computing
- ESE 3050 | Foundations of Data Science

Statistics

- CIS 2610 | Discrete Probability, Stochastic Processes, and Statistical Inference
- ESE 3010 | Engineering Probability
- STAT 4300 | Probability
- STAT 4760 | Applied Probability Models in Marketing

Data Collection, Representation, Management and Retrieval

- CIS 4550/5550 | Internet and Web Systems
- CIS 4500 | Database and Information Systems

### Data Analysis

- CIS 4190 | Applied Machine Learning
- CIS 4210 | Artificial Intelligence
- CIS 5200 | Machine Learning
- MKTG 2120 | Data and Analysis for Marketing Decisions
- MKTG 3090 | Special Topics: Experiments for Business Decision Making
- OIDD 4100 | Decision Support Systems
- STAT 4220 | Predictive Analytics for Business
- STAT 4350 | Forecasting Methods for Management
- STAT 4710 | Modern Data Mining
- STAT 4740 | Modern Regression for the Social, Behavioral and Biological Sciences
- STAT 5200 | Applied Econometrics I

### Modeling

- NETS 3120 | Theory of Networks
- MKTG 2710 | Models for Marketing Strategy
- OIDD 3250 | Computer Simulation Models
- OIDD 3530 | Mathematical Modeling and its Application in Finance
- STAT 4330 | Stochastic Processes

**Total Course Units**

6

1 Approval required.

2 Both CIS 4190/5190 and CIS 5200 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 2022 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.

2022-23 Catalog | Generated 08/12/22