DATA SCIENCE, B.S.

Students in the Data Science major will be able to apply computational, mathematical, and statistical thinking to data-rich problems in a wide variety of fields in a responsible and ethical manner. This includes the ability to manage, process, model, gain meaning and knowledge, and present data. Data Science is one of the fastest growing career sectors in Wisconsin and across the nation.

By its very nature, the field of data science is one that teaches novel and cutting-edge ways to engage in the “continual sifting and winnowing by which alone the truth can be found.”

HOW TO GET IN

To declare the data science major, student should set up an appointment with a data science major advisor prior to attaining senior standing (86 credits). There are no specific courses that must be completed before declaration.

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (http://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext) section of the Guide.

General Education

- Breadth—Humanities/Literature/Arts: 6 credits
- Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits
- Breadth—Social Studies: 3 credits
- Communication Part A & Part B *
- Ethnic Studies *
- Quantitative Reasoning Part A & Part B *

* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

Liberal Arts and Science Coursework

Depth of Intermediate/Advanced work

Major

- Declare and complete at least one (1) major

Total Credits

- 120 credits

UW-Madison

- 30 credits in residence, overall
- 30 credits in residence after the 86th credit

Minimum

- 2,000 in all coursework at UW–Madison

GPAs

- 2,000 in intermediate/advanced coursework at UW–Madison

NON–L&S STUDENTS PURSUING AN L&S MAJOR

Non–L&S students who have permission from their school/college to pursue an additional major within L&S only need to fulfill the major requirements and do not need to complete the L&S breadth and degree requirements above. Please note that the following special degree programs are not considered majors so are not available to non-L&S-degree-seeking candidates:

- Applied Mathematics, Engineering and Physics (Bachelor of Science–Applied Mathematics, Engineering and Physics)
- Journalism (Bachelor of Arts–Journalism; Bachelor of Science–Journalism)
- Music (Bachelor of Music)
- Social Work (Bachelor of Social Work)

REQUIREMENTS FOR THE MAJOR

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 221</td>
<td>Calculus and Analytic Geometry I</td>
<td>5</td>
</tr>
<tr>
<td>or MATH 217</td>
<td>Calculus with Algebra and Trigonometry II</td>
<td>5</td>
</tr>
<tr>
<td>or MATH 275</td>
<td>Topics in Calculus I</td>
<td>5</td>
</tr>
</tbody>
</table>
Data Science, B.S.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 222</td>
<td>Calculus and Analytic Geometry 2</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 276</td>
<td>Topics in Calculus II</td>
<td></td>
</tr>
</tbody>
</table>

**Foundational Data Science Courses**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 240</td>
<td>Introduction to Data Modeling I</td>
<td>4</td>
</tr>
<tr>
<td>STAT 340</td>
<td>Introduction to Data Modeling II</td>
<td>4</td>
</tr>
<tr>
<td>COMP SCI 220</td>
<td>Data Programming I</td>
<td>4</td>
</tr>
<tr>
<td>COMP SCI 320</td>
<td>Data Programming II</td>
<td>4</td>
</tr>
<tr>
<td>L I S 461</td>
<td>Data and Algorithms: Ethics and Policy</td>
<td>3-4</td>
</tr>
</tbody>
</table>

**Code**

**Title**

**Credits**

**Electives**

**18**

Students must take at least one course from each of the four following categories and then additional electives to reach the minimum credits. Additional courses taken within each category may count towards other electives.

**Machine Learning**

Select one of the following:

- COMP SCI/E C E/ M E 532 Matrix Methods in Machine Learning 2
- COMP SCI/E C E/ M E 539 Introduction to Artificial Neural Networks
- COMP SCI 540 Introduction to Artificial Intelligence
- MATH 535 Mathematical Methods in Data Science
- STAT 451 Introduction to Machine Learning and Statistical Pattern Classification
- STAT 453 Introduction to Deep Learning and Generative Models

**Advanced Computing**

Select one of the following:

- COMP SCI 400 Programming III
- COMP SCI 412 Introduction to Numerical Methods
- COMP SCI/ STAT 471 Introduction to Computational Statistics
- COMP SCI/ MATH 513 Numerical Linear Algebra
- COMP SCI/ MATH 514 Numerical Analysis
- COMP SCI/E C E/ I SY E 524 Introduction to Optimization
- COMP SCI 564 Database Management Systems: Design and Implementation
- GEOG 573 Advanced Geocomputing and Geospatial Big Data Analytics
- GEOG 574 Geospatial Database Design and Development

**Linear Algebra**

Select one from the following:

- MATH 320 Linear Algebra and Differential Equations
- MATH 340 Elementary Matrix and Linear Algebra
- MATH 341 Linear Algebra
- MATH 375 Topics in Multi-Variable Calculus and Linear Algebra
- COMP SCI/E C E/ M E 532 Matrix Methods in Machine Learning 2

**Other Electives**

**6-9**

For additional electives select from the courses listed below or additional courses from the required categories above:

- E C E 203 Signals, Information, and Computation
- ECON 570 Fundamentals of Data Analytics for Economists
- GEOG 572 Graphic Design in Cartography
- GEOG 575 Interactive Cartography & Geovisualization
- I SY E 323 Operations Research-Deterministic Modeling
- I SY E 412 Fundamentals of Industrial Data Analytics
- I SY E/M E 512 Inspection, Quality Control and Reliability
- I SY E 575 Introduction to Quality Engineering
- I SY E 612 Information Sensing and Analysis for Manufacturing Processes
- COMP SCI/I SY E/ MATH 425 Introduction to Combinatorial Optimization
RESIDENCE & QUALITY OF WORK

- 2.000 GPA in all major courses
- 2.000 GPA in all upper level work in the major
- 15 credits in the major, taken on the UW-Madison campus

Students who take COMP SCI/E C E/M E 532 Matrix Methods in Machine Learning may count the course towards both their linear algebra and machine learning requirements. However, students should be aware that some elective courses, in MATH in particular, require linear algebra courses as a prerequisite.

Upper-level in the major includes L I S 461 Data and Algorithms: Ethics and Policy and all courses listed in the Data Science Electives (i.e. Machine Learning, Advanced Computing, Statistical Modeling, Linear Algebra, and Other Electives).

UNIVERSITY DEGREE REQUIREMENTS

Total Degree To receive a bachelor’s degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.

Residency Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. ‘In residence’ means on the UW–Madison campus with an undergraduate degree classification. ‘In residence’ credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.

Quality of Work Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.

LEARNING OUTCOMES

1. Integrate foundational concepts and tools from mathematics, computer science, and statistics to solve data science problems.
2. Demonstrate competencies with tools and processes necessary for data management and reproducibility.
3. Produce meaning from data employing modeling strategies.
4. Demonstrate critical thinking related to data science concepts and methods.
5. Conduct data science activities aware of and according to policy, privacy, security and ethical considerations.
6. Demonstrate oral, written, and visual communication skills related to data science.

FOUR-YEAR PLAN

SAMPLE FOUR-YEAR PLAN

This Sample Four-Year Plan is a tool to assist students and their advisor(s). Students should use it—along with their DARS report, the Degree Planner, and Course Search & Enroll tools—to make their own four-year plan based on their placement scores, credit for transferred courses and approved examinations, and individual interests. As students become involved in athletics, honors, research, student organizations, study abroad, volunteer experiences, and/or work, they might adjust the order of their courses to accommodate these experiences. Students will likely revise their own four-year plan several times during college.

SAMPLE FOUR-YEAR PLAN

This Sample Four-Year Plan is a tool to assist students and their advisor(s). Students should use it—along with their DARS report, the Degree Planner, and Course Search & Enroll tools—to make their own four-year plan based on their placement scores, credit for transferred courses and approved examinations, and individual interests. As students become involved in athletics, honors, research, student organizations, study abroad, volunteer experiences, and/or work, they might adjust the order of their courses to accommodate these experiences. Students will likely revise their own four-year plan several times during college.

Freshman

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Credits</th>
<th>Spring Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP SCI 220</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Communication A</td>
<td>3</td>
<td>MATH 221</td>
</tr>
<tr>
<td>Biological Science Breadth</td>
<td>3</td>
<td>Ethnic Studies</td>
</tr>
<tr>
<td>Foreign Language (if needed)</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

14 16

Sophomore

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Credits</th>
<th>Spring Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 222</td>
<td>4</td>
<td>STAT 340</td>
</tr>
<tr>
<td>STAT 240</td>
<td>4</td>
<td>Linear Algebra course</td>
</tr>
<tr>
<td>Literature Breadth</td>
<td>3</td>
<td>Humanities Breadth</td>
</tr>
<tr>
<td>Physical Science Breadth</td>
<td>3</td>
<td>Literature Breadth</td>
</tr>
<tr>
<td>INTER-LS 210</td>
<td>1</td>
<td>Social Science Breadth</td>
</tr>
</tbody>
</table>

15 16

Junior

<table>
<thead>
<tr>
<th>Course</th>
<th>Fall Credits</th>
<th>Spring Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>L I S 461 (enroll in Communication B section)</td>
<td>3-4 Statistical Modeling course</td>
<td></td>
</tr>
<tr>
<td>Machine Learning course</td>
<td>3</td>
<td>Physical Science Breadth</td>
</tr>
<tr>
<td>Biological Science Breadth</td>
<td>3</td>
<td>Social Science Breadth</td>
</tr>
</tbody>
</table>

3
Data Science, B.S.

| Social Science Breadth | 3 Electives | 6
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Senior Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
</tr>
</tbody>
</table>
| Advanced Computing course | 3 Data Science elective | 3
| Data Science elective | 3 Electives | 10
| Social Science Breadth | 3
| Electives           | 6           |
|----------------------|
| Spring               |
| Total Credits 120    |

ADvising and Careers

Looking for Data Science Advising?
Students who are interested in data science academic advising should check out the advising information on our website (https://stat.wisc.edu/undergraduate-data-science-studies/) or send an email to dsmajor@stat.wisc.edu.

What Do Data Scientists Do?
Data Scientists are trained to manage, process, model, gain meaning and knowledge, and present data. These skills can be employed in a wide variety of different sectors of employment. Examples of interests of our students include finance, banking, sports analytics, marketing, retail, humanities, psychology, biosciences, healthcare, and consulting, just to name a few. Students are encouraged to combine data science with majors, certificates, and courses from differing areas to best be able to apply their data science in the area of their choosing.

Data science is one of the fastest growing area of jobs in the U.S. and in Wisconsin. All of the major job search engines regularly list thousands of jobs, for example, in 2018 Data Scientist was the #1 job on the website Glassdoor with over 25,000 jobs, Monster.com listed over 12,000 jobs in data science nationally, and Indeed.com had over 1,000 jobs for data analysts just in the state of Wisconsin.

Additionally, the Occupational Outlook Handbook (OOH) from the Bureau of Labor Statistics shows the job growth outlook from 2016-26 for Mathematicians and Statisticians to be 33% (much faster than average) and for Computer and Information Research Scientists to be 19% (much faster than average).

Some students may want to continue to develop additional advanced data science skills through graduate education.

L&S Career Resources
SuccessWorks at the College of Letters & Science helps students leverage the academic skills learned in their major, certificates, and liberal arts degree; explore and try out different career paths; participate in internships; prepare for the job search and/or graduate school applications; and network with professionals in the field (alumni and employers). In short, SuccessWorks helps students in the College of Letters & Science discover themselves, find opportunities, and develop the skills they need for success after graduation.

SuccessWorks can also assist students in career advising, résumé and cover letter writing, networking opportunities, and interview skills, as well as course offerings for undergraduates to begin their career exploration early in their undergraduate career.

Students should set up their profiles in Handshake (https://careers.ls.wisc.edu/handshake/) to take care of everything they need to explore career events, manage their campus interviews, and apply to jobs and internships from 200,000+ employers around the country.

- SuccessWorks (https://careers.ls.wisc.edu/)
- Set up a career advising appointment (https://careers.ls.wisc.edu/make-an-appointment/)
- INTER-LS 210 L&S Career Development: Taking Initiative (1 credit, targeted to first- and second-year students)—for more information, see Inter-LS 210: Career Development, Taking Initiative (https://careers.ls.wisc.edu/inter-ls-210-career-development-taking-initiative/)
- INTER-LS 215 Communicating About Careers (3 credits, fulfills Com B General Education Requirement)
- Handshake (https://careers.ls.wisc.edu/handshake/)
- Learn how we’re transforming career preparation: L&S Career Initiative (http://ls.wisc.edu/lsci/)

People

Advice Staff
Sara Rodock

Data Science Major Program Committee
- Michael Ferris (Computer Sciences)
- Bret Larget, Program Director (Statistics)
- Sebastien Roch (Mathematics)
- Alan Rubel (iSchool)

Resources and Scholarships
Visit the Wisconsin Scholarship Hub (https://wisc.academicworks.com/) (WiSH) to find UW–Madison scholarships and apply online.