DATA SCIENCE, B.A.

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.

Please see the Data Science major page (https://stat.wisc.edu/undergraduate-data-science-studies/) on the Department of Statistics website for information on how to declare the major and meet with advisors.

Students declared in the Data Science certificate may not be declared in the Data Science major at the same time. Students who do wish to declare this major must first cancel their declaration in the certificate.

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.

COLLEGE OF LETTERS & SCIENCE DEGREE REQUIREMENTS: BACHELOR OF ARTS (B.A.)

Students pursuing a bachelor of arts degree in the College of Letters & Science must complete all of the requirements below. The College of Letters & Science allows this major to be paired with either a bachelor of arts or a bachelor of science curriculum.

BACHELOR OF ARTS DEGREE REQUIREMENTS

Mathematics	Complete the University General Education Requirements for Quantitative Reasoning A (QR-A) and Quantitative Reasoning B (QR-B) coursework.
Foreign Language	• Complete the fourth unit of a foreign language; OR • Complete the third unit of a foreign language and the second unit of an additional foreign language.
L&S Breadth	• 12 credits of Humanities, which must include 6 credits of literature; and • 12 credits of Social Science; and • 12 credits of Natural Science, which must include one 3+ credit Biological Science course and one 3+ credit Physical Science course.
Liberal Arts and Science Coursework	Complete at least 108 credits.
Depth of Intermediate/Advanced work	Complete at least 60 credits at the intermediate or advanced level.
Major	Declare and complete at least one major.
Total Credits	Complete at least 120 credits.
UW-Madison Experience	• 30 credits in residence, overall; and • 30 credits in residence after the 86th credit.
Quality of Work	• 2.000 in all coursework at UW–Madison • 2.000 in Intermediate/Advanced level 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. They do not need to complete the L&S Degree Requirements above.

REQUIREMENTS FOR THE MAJOR

Code	Title	Credits
Foundational Math Courses		
MATH 221	Calculus and Analytic Geometry 1	5
or MATH 217	Calculus with Algebra and Trigonometry II	
or MATH 275	Topics in Calculus I	
MATH 222	Calculus and Analytic Geometry 2	4
or MATH 276	Topics in Calculus II	

Code	Title	Credits
Foundational Data Science Courses		
STAT 240	Data Science Modeling I	4
STAT 340	Data Science Modeling II	4
COMP SCI 220	Data Science Programming I	4
or COMP SCI 300	Programming II	
COMP SCI 320	Data Science Programming II	4
L I S 461	Data and Algorithms: Ethics and Policy	3-4

Code	Title	Credits
Electives		**18**
Students must complete 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		*3*
Complete one of the following:		
COMP SCI/E C E/ M E 532	Matrix Methods in Machine Learning	
COMP SCI/E C E/ M E 539	Introduction to Artificial Neural Networks	
COMP SCI 540	Introduction to Artificial Intelligence	
GEN BUS 656	Machine Learning for Business Analytics	
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		*3*
Complete 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	
COMP SCI/ B M I 576	Introduction to Bioinformatics	
GEOG 573	Advanced Geocomputing and Geospatial Big Data Analytics	
GEOG 574	Geospatial Database Design and Development	
Statistical Modeling		*3*
Complete one of the following:		
ECON 400	Introduction to Applied Econometrics	
ECON 410	Introductory Econometrics	
STAT/MATH 309	Introduction to Probability and Mathematical Statistics I	
STAT/MATH 310	Introduction to Probability and Mathematical Statistics II	
STAT 311	Introduction to Theory and Methods of Mathematical Statistics I	
STAT 312	Introduction to Theory and Methods of Mathematical Statistics II	
STAT 349	Introduction to Time Series	
STAT 351	Introductory Nonparametric Statistics	
STAT 421	Applied Categorical Data Analysis	
STAT/M E 424	Statistical Experimental Design	
STAT/MATH 431	Introduction to the Theory of Probability	
STAT 443	Classification and Regression Trees	
STAT 456	Applied Multivariate Analysis	
STAT 461	Financial Statistics	
MATH 531	Probability Theory	
MATH/I SY E/ OTM/STAT 632	Introduction to Stochastic Processes	
MATH 635	An Introduction to Brownian Motion and Stochastic Calculus	
Linear Algebra		*3*
Complete 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	
Other Electives		*6*
For additional electives students may complete courses from the list below or additional courses from the required categories above:		
COMP SCI/I SY E/ MATH 425	Introduction to Combinatorial Optimization	
COMP SCI/I SY E/ MATH/STAT 525	Linear Optimization	

COMP SCI/ E C E 533	Image Processing
COMP SCI 559	Computer Graphics
COMP SCI/ B M I 567	Medical Image Analysis
COMP SCI 577	Introduction to Algorithms
E C E 203	Signals, Information, and Computation
ECON 315	Data Visualization for Economists
ECON 570	Fundamentals of Data Analytics for Economists
ECON 695	Topics in Economic Data Analysis
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
L I S 407	Data Storytelling with Visualization
L I S 464	Applied Database Design
L I S 501	Introduction to Text Mining
SOC 351	Introduction to Survey Methods for Social Research
SOC/ C&E SOC 693	Practicum in Analysis and Research
STAT 433	Data Science with R

RESIDENCE & QUALITY OF WORK

- 2.000 GPA in all major courses
- 2.000 GPA in all upper level work in the major[1]
- 15 credits in the major, taken on the UW-Madison campus

FOOTNOTES

1

Upper-level in the major includes L I S 461 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.

Freshman

Fall	Credits	Spring	Credits
COMP SCI 220	4	COMP SCI 320	4
Communication A	3	MATH 221	5
Biological Science Breadth	3	Ethnic Studies	3
Foreign Language (if needed)	4	Foreign Language (if needed)	4
	14		**16**

Sophomore

Fall	Credits	Spring	Credits
MATH 222	4	STAT 340	4
STAT 240	4	Linear Algebra course	3
Literature Breadth	3	Humanities Breadth	3

Physical Science Breadth	3	Literature Breadth	3
INTER-LS 210	1	Social Science Breadth	3
	15		**16**

Junior

Fall	Credits	Spring	Credits
L I S 461 (enroll in Communication B section)	3-4	Statistical Modeling course	3
Machine Learning course	3	Physical Science Breadth	3
Biological Science Breadth	3	Social Science Breadth	3
Social Science Breadth	3	Electives	6
Elective	3		
	16		**15**

Senior

Fall	Credits	Spring	Credits
Advanced Computing course	3	Data Science elective	3
Data Science elective	3	Electives	10
Social Science Breadth	3		
Electives	6		
	15		**13**

Total Credits 120

THREE-YEAR PLAN

SAMPLE THREE-YEAR PLAN

This Sample Three-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 three-year plan based on their placement scores, credit for transferred courses and approved examinations, and individual interests.

Three-year plans may vary considerably from student to student, depending on their individual preparation and circumstances. Students interested in graduating in three years should meet with an advisor as early as possible to discuss feasibility, appropriate course sequencing, post-graduation plans (careers, graduate school, etc.), and opportunities they might forgo in pursuit of a three-year graduation plan.

DEPARTMENTAL EXPECTATIONS

A three-year degree is feasible for students with a variety of backgrounds and specific preparation. Students should ideally be entering the University with a minimum of 30 advanced standing credits, and have satisfied the following requirements with course credit or via placement examination:

- MATH 221 Calculus and Analytic Geometry 1
- MATH 222 Calculus and Analytic Geometry 2
- 3-4 units of foreign language

First Year

Fall	Credits	Spring	Credits
STAT 240	4	STAT 340	4
COMP SCI 220	4	COMP SCI 320	4
Communications A complete during first year	3	Ethnics Studies complete within first 60 credits	3
Social Science Breadth	3	Humanities Breadth	3
	14		**14**

Second Year

Fall	Credits	Spring	Credits
L I S 461 (meets Humanities Breadth, 4cr section meets Communication B)	3-4	Machine Learning Course	3
Linear Algebra Course	3	Statistical Modeling Course	3
Biological Science Breadth	3	Literature Breadth	3
Social Science Breadth	3	Physical Science Breadth	3
Elective	3-4	INTER-LS 210	1
		Elective	3
	16		**16**

Third Year

Fall	Credits	Spring	Credits
Advanced Computing Course	3	Data Science Elective	3
Data Science Elective	3	Literature Breath	3
Science Breadth	3	Science Breadth	3
Social Science Breadth	6	Electives	6
	15		**15**

Total Credits 90

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 web site 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

Every L&S major opens a world of possibilities. SuccessWorks (https://successworks.wisc.edu/) at the College of Letters & Science helps students turn the academic skills learned in their major, certificates, and other coursework into fulfilling lives after graduation, whether that means jobs, public service, graduate school or other career pursuits.

In addition to providing basic support like resume reviews and interview practice, SuccessWorks offers ways to explore interests and build career skills from their very first semester/term at UW all the way through graduation and beyond.

Students can explore careers in one-on-one advising, try out different career paths, complete internships, prepare for the job search and/or graduate school applications, and connect with supportive alumni and even employers in the fields that inspire them.

- SuccessWorks (https://careers.ls.wisc.edu/)
- Set up a career advising appointment (https://successworks.wisc.edu/make-an-appointment/)
- Enroll in a Career Course (https://successworks.wisc.edu/career-courses/) - a great idea for first- and second-year students:
  - INTER-LS 210 L&S Career Development: Taking Initiative (1 credit)
  - INTER-LS 215 Communicating About Careers (3 credits, fulfills Comm B General Education Requirement)
- Learn about internships and internship funding (https://successworks.wisc.edu/finding-a-job-or-internship/)
- Activate your Handshake account (https://successworks.wisc.edu/handshake/) to apply for jobs and internships from 200,000+ employers recruiting UW-Madison students
- Learn about the impact SuccessWorks has on students' lives (https://successworks.wisc.edu/about/mission/)

PEOPLE

ADVISING STAFF

Information regarding the Data Science advisors and how to make appointment can be found on the program page (https://stat.wisc.edu/undergraduate-data-science-studies/).

DATA SCIENCE MAJOR PROGRAM COMMITTEE

- Tyler Caraza-Harter (Computer Sciences)
- Michael Ferris (Computer Sciences)
- B. Ian Hutchins (iSchool)
- Bret Larget, Program Director (Statistics), committee chair
- Sebastien Roch (Mathematics)
- Sara Rodock (Statistics), advising representative

RESOURCES AND SCHOLARSHIPS

Helpful resources can be found at scholarships (https://financialaid.wisc.edu/types-of-aid/scholarships/) and Wisconsin Scholarship Hub (https://wisc.academicworks.com/).