DATA SCIENCE, BA

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

HOW TO GET IN

To declare the data science major, student should meet with a data science major advisor prior to attaining senior standing (86 credits).

Students must have a 2.000 GPA on coursework counting in the major, and a 2.000 GPA on any upper-level work in the major completed prior to declaration. No specific coursework must be completed to declare.

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 Data Science certificate.

Students declared in the Statistics 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 Statistics 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 (BA)

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.
Language	• Complete the fourth unit of a language other than English; OR • Complete the third unit of a language and the second unit of an additional language other than English.
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	
MATH 222	Calculus and Analytic Geometry 2	4
Total Credits		**9**

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 (4-credit Communication B section optional)	3-4
or E C E/ I SY E 570	Ethics of Data for Engineers	
Total Credits		**19-20**

Code	Title	Credits
Electives		
Students must complete at least one course from each of the four following categories, plus additional electives to reach the minimum credits. Additional courses taken within each category (except for linear algebra) may count towards other electives. [2]		
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	
I SY E 521	Machine Learning in Action for Industrial Engineers	
MATH 535	Mathematical Methods in Data Science	
PHYSICS 361	Machine Learning in Physics	
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 544	Introduction to Big Data Systems	
COMP SCI 564	Database Management Systems: Design and Implementation	
COMP SCI 565	Introduction to Data Visualization	
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	
MATH 444	Graphs and Networks in Data Science	
Statistical Modeling		*3*
Complete one of the following:		
ECON 400	Introduction to Applied Econometrics	
ECON 410	Introductory Econometrics	
ECON 460	Economic Forecasting	
GEOG 579	GIS and Spatial Analysis	
I SY E 575	Introduction to Quality Engineering	
STAT/MATH 309	Introduction to Probability and Mathematical Statistics I [2]	
or STAT 311	Introduction to Theory and Methods of Mathematical Statistics I	
or MATH/ STAT 431	Introduction to the Theory of Probability	
STAT/MATH 310	Introduction to Probability and Mathematical Statistics II [2]	
or 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 436	Statistical Data Visualization	
STAT 443	Classification and Regression Trees	
STAT 456	Applied Multivariate Analysis	
STAT 461	Financial Statistics	

STAT 575	Statistical Methods for Spatial Data
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. Only one course from the linear algebra list can be used towards the major: [2]	
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: [2]	
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 378	Introduction to Geocomputing
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 612	Information Sensing and Analysis for Manufacturing Processes
INFO SYS 322	Introduction to Databases
L I S 407	Data Storytelling with Visualization
L I S 440	Navigating the Data Revolution: Concepts of Data & Information Science
L I S 464	Applied Database Design
L I S 501	Introduction to Text Mining
LSC 460	Social Media Analytics
LSC 660	Data Analysis in Communications Research
MATH 331	Introductory Probability [2]
SOC 351	Introduction to Survey Methods for Social Research
SOC/ C&E SOC 618	Social Network Analysis
SOC/ C&E SOC 693	Practicum in Analysis and Research
SOIL SCI 585	Using R for Soil and Environmental Sciences
STAT 405	Data Science Computing Project
STAT 433	Data Science with R
Total Credits	**18**

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 counting towards the Electives requirement (i.e. Machine Learning, Advanced Computing, Statistical Modeling, Linear Algebra, and Other Electives).

[2] Students are only allowed to count one course from each of **probability** (MATH 331, STAT/MATH 309, STAT 311, or STAT/MATH 431), **inference** (STAT/MATH 310 or STAT 312), and **linear algebra** (MATH 320, MATH 340, MATH 341, or MATH 375) towards the major.

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

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
Advanced Computing course	3	Statistical Modeling course	3
Biological Science Breadth	3	Physical Science Breadth	3
Social Science Breadth	3	Social Science Breadth	3
Elective	6	Electives	6
	15		**15**

Senior

Fall	Credits	Spring	Credits
L I S 461 (Meets Humanities breadth; 4-credit Communication B section optional)	3-4	Data Science elective	3
Machine Learning course	3	Data Science elective	3
Social Science Breadth	3	Electives	7
Electives	6		
	15		**14**

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
Linear Algebra Course	3	Advanced computing course	3
Statistical Modeling course	3-4	Data Science elective	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
	15		**16**

Third Year

Fall	**Credits**	**Spring**	**Credits**
L I S 461 (Meets Humanities breadth; 4-credit Communication B section optional)		3-4 Data Science Elective	3
Machine Learning course		3 Literature Breath	3
Science Breadth		3 Science Breadth	3
Social Science Breadth		6 Electives	6
	16		**15**

Total Credits 90

ADVISING AND CAREERS

ADVISING AND CAREERS

LOOKING FOR DATA SCIENCE ADVISING?

Information on group declaration sessions, individual advising appointments, drop-in advising, and contact information for advisors is available on our website (https://stat.wisc.edu/undergraduate-data-science-studies/).

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 areas of jobs in the U.S. and in Wisconsin. All of the major job search engines regularly list a multitude of positions, for example, in 2022 Data Scientist was the #3 job on the website Glassdoor with over 10,000 jobs, Indeed.com had over 20,000 jobs for data science, and thousands of positions in multiple data oriented categories can be found on Monster.com.

Additionally, the Occupational Outlook Handbook (OOH) from the Bureau of Labor Statistics (https://www.bls.gov/ooh/math/data-scientists.htm) shows the job growth outlook from 2021-31 for Data Scientists to be 36% (much faster than average).

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

DEPARTMENTAL RESOURCES

- Data Science Skills Sheet (https://drive.google.com/file/d/1Srak_e7Arr4XA9WBZ0xiOTPZnlUxPfsE/view/), aka What you can do with your Data Science major
- Career Pathways for Statistics and Data Science Canvas Course (https://canvas.wisc.edu/enroll/3JWLRW/)
- Department of Statistics Student Career Resources webpage (https://stat.wisc.edu/student-career-resources/)

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/)
  - INTER-LS 260 Internship in the Liberal Arts and Sciences
- 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

PEOPLE

ADVISING STAFF

Information regarding the Data Science advisors and how to make an 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
- Nan Chen (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 the Wisconsin Scholarship Hub (https://wisc.academicworks.com/). Additional information specific to Data Science students can be found on our major webpage (https://stat.wisc.edu/undergraduate-data-science-studies/) and opportunities are regularly sent to declared students via our weekly newsletter.