# DATA SCIENCE, BA

## 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 (https://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext) section of the Guide.

| | |
|---|---|
| General Education | • Breadth—Humanities/Literature/Arts: 6 credits<br>• 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<br>• Breadth—Social Studies: 3 credits<br>• Communication Part A & Part B *<br>• Ethnic Studies *<br>• 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<br>• 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<br>• 12 credits of Social Science; and<br>• 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<br>• 30 credits in residence after the 86th credit. |
| Quality of Work | • 2.000 in all coursework at UW–Madison<br>• 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

### FOUNDATIONAL MATH COURSES

| Code | Title | Credits |
|---|---|---|
| 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** |

### FOUNDATIONAL DATA SCIENCE COURSES

| Code | Title | Credits |
|---|---|---|
| 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 |
| or E C E/ I SY E 570 | Ethics of Data for Engineers | |
| or PHILOS 244 | Introductory Artificial Intelligence (AI) and Data Ethics | |
| **Total Credits** | | **19-20** |

## ELECTIVES

Students must complete 18 credits of upper-level major electives, including at least one course from each of the the following categories: Linear Algebra, Advanced Computing, Statistical Modeling, and Machine Learning, plus additional electives to reach the minimum credits.

Additional courses taken within Advanced Computing, Statistical Modeling, and Machine Learning may count towards other electives.

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, MATH 345, or MATH 375) towards the major.

### Linear Algebra

| Code | Title | Credits |
|---|---|---|
| Choose one from the following: | | 3 |
| Only one linear algebra course may count towards the data science major | | |
| MATH 320 | Linear Algebra and Differential Equations | |
| MATH 340 | Elementary Matrix and Linear Algebra | |
| MATH 341 | Linear Algebra | |
| MATH 345 | Linear Algebra and Optimization | |
| MATH 375 | Topics in Multi-Variable Calculus and Linear Algebra | |
| **Total Credits** | | **3** |

### Advanced Computing

| Code | Title | Credits |
|---|---|---|
| Complete at least one from the following: | | 3 |
| COMP SCI 400 | Programming III | |
| COMP SCI 412 | Introduction to Numerical Methods | |
| 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 557 | Parallel & Throughput- Optimized Programming | |
| 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 | |
| STAT/ COMP SCI 471 | Introduction to Computational Statistics | |
| **Total Credits** | | **3** |

### Statistical Modeling

| Code | Title | Credits |
|---|---|---|
| Complete at least one from the following: | | 3 |
| ACT SCI 657 | Risk Analytics | |
| CIV ENGR 516 | Hydrologic Data Analysis | |
| ECON 400 | Introduction to Applied Econometrics | |
| ECON 410 | Introductory Econometrics | |
| ECON 460 | Economic Forecasting | |
| GEOG 560 | Advanced Quantitative Methods | |
| GEOG 579 | GIS and Spatial Analysis | |
| I SY E 575 | Introduction to Quality Engineering | |
| 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 | |
| STAT/MATH 309 | Introduction to Probability and Mathematical Statistics I | |
| 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 | |
| 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 | |
| **Total Credits** | | **3** |

### Machine Learning

| Code | Title | Credits |
|---|---|---|
| Complete at least one from the following: | | 3 |
| BSE 405 | Artificial Intelligence in Agriculture | |
| CHEM 361 | Machine Learning in Chemistry | |
| 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 | |
| I SY E 521 | Machine Learning in Action for Industrial Engineers | |

| | |
|---|---|
| MATH 535 | Mathematical Methods in Data Science |
| MATH 616 | Data-Driven Dynamical Systems, Stochastic Modeling and Prediction |
| 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 |
| **Total Credits** | **3** |

### Other electives

| Code | Title | Credits |
|---|---|---|
| For additional electives, complete up to two courses from the list below or additional courses from the required categories above: | | 6 |
| ACT SCI 655 | Health Analytics | |
| 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 541 | Theory & Algorithms for Data Science | |
| COMP SCI 559 | Computer Graphics | |
| COMP SCI/ B M I 567 | Biomedical 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 | |
| F&W ECOL 395 | Data and GIS Tools for Ecology | |
| F&W ECOL 458 | Environmental Data Science | |
| GEN BUS 317 | Mathematical Foundations of Business Analytics | |
| GEOG 378 | Introduction to Geocomputing | |
| GEOG 572 | Graphic Design in Cartography | |
| GEOG 575 | Interactive Cartography & Geovisualization | |
| INFO SYS 322 | Introduction to Databases | |
| INFO SYS 423 | Digital Platform Analytics | |
| 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 | |
| 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 | |
| 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** | | **6** |

# 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).

# UNIVERSITY DEGREE REQUIREMENTS

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|---|---|
| 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. |