DATA SCIENCE (CAS)

Description

The interdisciplinary data science major prepares students with skill and competency in data analysis and interpretation, algorithm design and implementation, and helps them develop aptitudes for interdisciplinary problem-solving. Thus, this program enables students to take advantage of career and employment opportunities across diverse fields involving data-rich, data-driven systems and applications. Ultimately, this will help address the increasing societal and economic need for a qualified workforce in today's digital age.

The data science major is available through the College of Art and Sciences, the College of Engineering, and the College of Agricultural Sciences and Natural Resources. A shared set of core requirements exists in each college combining foundational knowledge in Computer Science, Mathematics, and Statistics. Beyond the core requirements, each college offers a unique approach within the overall degree. The College of Arts and Sciences data science majors will have the opportunity to pursue the major as part of an overall liberal arts curriculum characterized by both focus and range. Due to the flexible and customizable structure of the degrees, the major will pair well with a related minor or even a second major.

College Admission

The entrance requirements for the College of Arts and Sciences (CAS), including any of the majors or minors offered through the college, are the same as the University of Nebraska–Lincoln General Admission Requirements. In addition to these requirements, the College of Arts and Sciences strongly recommends a third and fourth year of one foreign language in high school. Four years of high school coursework in the same language will fulfill the College of Arts and Sciences' language requirement. It will also allow students to continue language study at a more advanced level at the University of Nebraska–Lincoln and provide more opportunity to study abroad.

Academic and Career Advising

Academic and Career Advising Center

Not sure where to go or who to ask? The Advising Center team in 107 Oldfather Hall can help. The Academic and Career Advising Center is the undergraduate hub for CAS students in all majors. Centrally located and easily accessed, students encounter friendly, knowledgeable people who are eager to help or connect students to partner resources. Students also visit the Advising Center in 107 Oldfather Hall to:

- Choose or change their major, minor, or degree program.
- Check on policies, procedures, and deadlines.
- Get a college approval signature from the Dean's representatives.

CAS Career Coaches are available by appointment (in-person or zoom) and located in the CAS Academic and Career Advising Center, 107 Oldfather Hall. They help students explore majors and minors, gain experience, and develop a plan for life after graduation.

Assigned Academic Advisors

Academic advisors are critical resources dedicated to students' academic, personal, and professional success. Every CAS student is assigned an academic advisor based on their primary major. Since most CAS students have more than just a single major, it is important to get to know the advisor for any minors or additional majors. Academic advisors work closely with the faculty to provide the best overall support and the discipline specific expertise. They are available for appointments (in-person or zoom) and through weekly virtual drop-ins. Assigned advisors are listed in MyRED (https://its.unl.edu/myunl/) and their offices may be located in or near the department of the major for which they advise.

Students who have declared a pre-health or pre-law area of interest will also work with advisors in the Exploratory and Pre-Professional Advising Center (Explore Center) in 127 Love South, who are specially trained to guide students preparing to enter a professional school.

For complete and current information on advisors for majors, minors, or pre-professional areas, visit https://cas.unl.edu/major-advisors (https://cas.unl.edu/major-advisors/), or connect with the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, casadvising@unl.edu.

Career Coaching

The College believes that **Academics + Experience = Opportunities** and encourages students to complement their academic preparation with real-world experience, including internships, research, education abroad, service, and leadership. Arts and sciences students have access to a powerful network of faculty, staff, and advisors dedicated to providing information and support for their goals of meaningful employment or advanced education. Arts and sciences graduates have unlimited career possibilities and carry with them important career competencies— communication, critical thinking, creativity, context, and collaboration. They have the skills and adaptably that employers universally value. Graduates are prepared to effectively contribute professionally and personally with a solid foundation to excel in an increasingly global, technological, and interdisciplinary world.

Students should contact the career coaches in the Arts and Sciences Academic and Career Advising Center in 107 Oldfather Hall, or their assigned advisor, for more information. The CAS career coaches help students explore career options, identify ways to build experience and prepare to apply for internships, jobs, or graduate school, including help with resumes, applications, and interviewing.

ACE Requirements

Students must complete one course for each of the ACE Student Learning Outcomes below. Certified course choices are published in the degree audit, or visit the ACE website (http://ace.unl.edu) for the most current list of certified courses.

ACE Student Learning Outcomes

ACE 1: Write texts, in various forms, with an identified purpose, that respond to specific audience needs, integrate research or existing knowledge, and use applicable documentation and appropriate conventions of format and structure.
ACE 2: Demonstrate competence in communication skills.
ACE 3: Use mathematical, computational, statistical, logical, or other formal reasoning to solve problems, draw inferences, justify conclusions, and determine reasonableness.

ACE 4: Use scientific methods and knowledge to pose questions, frame hypotheses, interpret data, and evaluate whether conclusions about the natural and physical world are reasonable.

ACE 5: Use knowledge, historical perspectives, analysis, interpretation, critical evaluation, and the standards of evidence appropriate to the humanities to address problems and issues.

ACE 6: Use knowledge, theories, and research perspectives such as statistical methods or observational accounts appropriate to the social sciences to understand and evaluate social systems or human behaviors.

ACE 7: Use knowledge, theories, or methods appropriate to the arts to understand their context and significance.

ACE 8: Use knowledge, theories, and analysis to explain ethical principles and their importance in society.

ACE 9: Exhibit global awareness or knowledge of human diversity through analysis of an issue.

ACE 10: Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection.

College Degree Requirements
College Distribution Requirements – BA and BS

The College of Arts and Sciences distribution requirements are common to both the bachelor of arts and bachelor of science degrees and are designed to ensure a range of courses. By engaging in study in several different areas within the College, students develop the ability to learn in a variety of ways and apply their knowledge from a variety of perspectives. All requirements are in addition to University ACE requirements, and no course can be used to fulfill both an ACE outcome and a College Distribution Requirement.

- A student may not use a single course to satisfy more than one College Distribution Requirement, with the exception of CDR Diversity. Courses used to meet CDR Diversity may also meet CDR Writing, CDR Humanities, or CDR Social Science.
- Independent study or reading courses and internships cannot be used to satisfy distribution requirements.
- Courses from interdisciplinary programs will be applied in the same area as courses from the home/cross-listed department.

College Distribution Requirements

CDR: Written Communication	*3*
Select from courses approved for ACE outcome 1.	
CDR: Natural, Physical, and Mathematical Sciences with Lab	*4*
Select from biochemistry, biological sciences, chemistry, computer science, geology, meteorology, mathematics, and physics. Must include one lab in the natural or physical sciences. Lab courses may be selected from biochemistry, biological sciences, chemistry, geology, meteorology, and physics.	
Some courses from geography and anthropology may also be used to satisfy the lab requirement above. [1]	
CDR: Humanities	*3*
Select from classics, English, film studies, history, modern languages and literatures, philosophy, and religious studies. [2]	

CDR: Social Science	*3*
Select from anthropology, communication studies, geography, national security studies, political science, psychology, or sociology. [3]	
CDR: Human Diversity in U.S. Communities	*0-3*
Select from a set of approved courses as listed in the degree audit.	
CDR: Language	*0-16*
Fulfilled by the completion of the 6-credit-hour second-year sequence in a single foreign language in one of the following departments: Classics and religious studies or modern languages and literatures. Instruction is currently available in Arabic, Chinese, Czech, French, German, Greek, Japanese, Latin, Russian, and Spanish.	
A student who has completed the fourth-year level of one foreign language in high school is exempt from the languages requirement, but encouraged to continue on in their language study.	
Credit Hours Subtotal:	13-32

[1] *See Degree Audit or a College of Arts and Sciences advisor for approved geography and anthropology courses that apply as natural science.*

[2] *Language courses numbered 220 and below do not fulfill the CDR Humanities.*

[3] *See Degree Audit or College of Arts and Sciences advisor for list of natural/physical science courses in anthropology, geography, and psychology that do not apply as social science.*

Language Requirement

The University of Nebraska–Lincoln and the College of Arts and Sciences place great value on academic exposure and proficiency in a second language. The University of Nebraska–Lincoln entrance requirement of two years of the same foreign language or the College's language distribution requirement (CDR: Language) will rarely be waived and only with relevant documentation. See the main College of Arts and Sciences page for more details.

Experiential Learning Requirement

All undergraduates in the College of Arts and Sciences must complete an Experiential Learning (EL) designated course. This may include 0-credit courses designed to document co-curricular activities recognized as Experiential Learning.

Scientific Base - BS Only

The bachelor of science degree requires students to complete 60 hours in mathematical, physical, and natural sciences. Approved courses for scientific-based credit come from the following College of Arts and Sciences disciplines: actuarial science, anthropology (selected courses), astronomy, biochemistry (excluding BIOC 101), biological sciences (excluding BIOS 100 or BIOS 203), chemistry (excluding CHEM 101), geography (selected courses), geology, life sciences, mathematics (excluding courses below MATH 104), meteorology, microbiology (excluding MBIO 101), and physics (excluding PHYS 201.)

See your Degree Audit or your assigned academic advisor for a complete list, including individual classes that fall outside of the disciplines listed above. Up to 12 hours of scientific and technical courses offered by other colleges may be accepted toward this requirement with approval of the

College of Arts and Sciences. See your assigned academic advisor to start the approval process.

Minimum Hours Required for Graduation

A minimum of 120 semester hours of credit is required for graduation from the College of Arts and Sciences. A cumulative grade point average of at least 2.0 is required.

Grade Rules

Restrictions on C- and D Grades

The College will accept no more than 15 semester hours of C- and D grades from other domestic institutions except for UNO and UNK. All courses taken at UNO and UNK impact the UNL transcript. No transfer of C- and D grades can be applied toward requirements in a major or a minor. No University of Nebraska–Lincoln C- and D grades can be applied toward requirements in a major or a minor. International coursework (including education abroad) with a final grade equivalent to a C- or lower will not be validated by the College of Arts and Sciences departments to be degree applicable.

Pass/No Pass Privilege

The College of Arts and Sciences adheres to the University regulations for the Pass/No Pass (P/N) privilege with the following additional regulations:

- Pass/No Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
- Most arts and sciences departments and programs do not allow courses graded Pass/No Pass to apply to the major or minor. Students should refer to the department's or program's section of the catalog for clarification. By college rule, departments can allow up to 6 hours of Pass/No Pass in the major or minor.
- Departments may specify that certain courses of theirs can be taken only on a P/N basis.
- The college will permit no more than a total of 24 semester hours of P/N grades to be applied toward degree requirements. This total includes all Pass grades earned at the University of Nebraska–Lincoln and other U.S. schools. **NOTE:** This 24-hour limit is more restrictive than the University regulation.

Grading Appeals

A student who feels that he/she has been unfairly graded must ordinarily take the following sequential steps in a timely manner, usually by initiating the appeal in the semester following the awarding of the grade:

1. Talk with the instructor concerned. Most problems are resolved at this point.
2. Talk to the instructor's department chairperson.
3. Take the case to the Grading Appeal Committee of the department concerned. The Committee should be contacted through the department chairperson.
4. Take the case to the College Grading Appeals Committee by contacting the Dean's Office, 1223 Oldfather Hall.

Course Level Requirements

Courses Numbered at the 300 or 400 Level

Thirty (30) of the 120 semester hours of credit must be in courses numbered at the 300 or 400 level. Of those 30 hours, 15 hours (1/2) must be completed in residence at the University of Nebraska–Lincoln.

Residency Requirement

Students must complete at least 30 of the 120 total hours for their degree at the University of Nebraska−Lincoln. Students must complete at least 1/2 of their major coursework, including 6 hours at the 300 or 400 level in their major and 15 of the 30 hours required at the 300 or 400 level, in residence. Credit earned during education abroad may be used toward the residency requirement only if students register through the University of Nebraska−Lincoln.

Catalog to Use

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to and enrolled as a degree-seeking student at the University of Nebraska−Lincoln. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at the University of Nebraska−Lincoln in the College of Arts and Sciences. Students must complete all degree requirements from a single catalog year. Beginning in 1990-1991, the catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Transfer Students: Students who have transferred from a community college may be eligible to fulfill the requirements as stated in the catalog for an academic year in which they were enrolled at the community college prior to attending the University of Nebraska-Lincoln. This decision should be made in consultation with academic advisors, provided the student a) was enrolled in a community college during the catalog year they are utilizing, b) maintained continuous enrollment at the previous institution for 1 academic year or more, and c) continued enrollment at the University of Nebraska-Lincoln within 1 calendar year from their last term at the previous institution. Students must complete all degree requirements from a single catalog year and within the time frame allowable for that catalog year.

Learning Outcomes

The primary student learning outcomes of the interdisciplinary data science major are:

1. Foundational knowledge and expertise in the analysis of large-scale data sources from the interdisciplinary perspectives of applied computer science, data modeling, mathematics, and statistics.
2. Foundational knowledge and expertise in the application of computing, informatics, and modeling to solve multidisciplinary problems.
3. Abilities and professional skills to solve multidisciplinary data science problems as a member of an interdisciplinary team.
4. Familiarity with ethical challenges in data science, including ethical collection of data, responsible use of data and algorithmic bias.

Major Requirements

The interdisciplinary data science major includes a set of core requirements, professional experience, and selection of fifteen (15) hours from two focus areas of interest.

Core Requirements

Computer Science

CSCE 155T	Computer Science I: Informatics Focus	3
or CSCE 155A	Computer Science I	
or CSCE 155E	Computer Science I: Systems Engineering Focus	

or CSCE 155H	Honors: Computer Science I	
or CSCE 155N	Computer Science I: Engineering and Science Focus	
CSCE 311	Data Structures and Algorithms for Informatics	3
or CSCE 310	Data Structures and Algorithms	
CSCE 320	Data Analysis	3
Credit Hours Subtotal:		9
Mathematics		
MATH 104	Applied Calculus	3-5
or MATH 106	Calculus I	
MATH 203	Contemporary Mathematics	3-4
or MATH 203J	Contemporary Math	
or MATH 107	Calculus II	
MATH 315	Linear Algebra for Data Science	3
or MATH 314	Linear Algebra	
Credit Hours Subtotal:		9-12
Statistics		
Select one of the following options:		6
Option 1		
STAT 218	Introduction to Statistics	
or STAT 380 RAIK 270H	Statistics and Applications	
STAT 318	Introduction to Statistics II	
Option 2		
STAT 101	Introduction to Data	
STAT 102	Principles of Statistical Analysis	
Credit Hours Subtotal:		6
Total Credit Hours		**24-27**

Specific Major Requirements

Professional Experience		
MATH 435	Math in the City	3
Credit Hours Subtotal:		3
Focus Area Courses		
Select at least 15 hours from two of the following focus areas, with at least 6 hours in each of the focus areas selected.		15
Artificial Intelligence		
CSCE 421	Foundations of Constraint Processing	
CSCE 472	Digital Image Processing	
CSCE 473	Computer Vision	
CSCE 474	Introduction to Data Mining	
CSCE 475	Multiagent Systems	
CSCE 476	Introduction to Artificial Intelligence	
CSCE 478	Introduction to Machine Learning	
CSCE 479	Introduction to Deep Learning	
Software Development		
CSCE 361	Software Engineering	
CSCE 378	Human-Computer Interaction	
CSCE 412	Data Visualization	
CSCE 460	Software Engineering for Robotics	
CSCE 461	Advanced Topics in Software Engineering	
CSCE 464	Internet Systems and Programming	
CSCE 466	Software Design and Architecture	
CSCE 467	Testing, Verification and Analysis	
CSCE 468	Requirements Elicitation, Modeling and Analysis	
Data Pipeline		
STAT 251	Statistical Computing I: Data Wrangling	
STAT 351	Statistical Computing II: Data Management and Visualization	
CSCE 411	Data Modeling for Systems Development	
CSCE 413	Database Systems	
CSCE 436	Advanced Embedded Systems	
CSCE 438	Internet of Things	
CSCE 458	Molecular and Nanoscale Communication	
CSCE 463	Data and Network Security	
CSCE 465	Wireless Communication Networks	
Mathematical Modeling		
MATH 208	Calculus III	
MATH 221	Differential Equations	
MATH 415	Theory of Linear Transformations	
MATH 424	Introduction to Partial Differential Equations	
MATH 428	Principles of Operations Research	
MATH 433	Nonlinear Optimization	
MATH 440	Numerical Analysis I	
MATH 447	Numerical Methods for Applied Math	
MATH 450	Combinatorics	
MATH 452	Graph Theory	
MATH 471	Introduction to Topology	
MATH 487	Probability Theory	
MATH 489	Stochastic Processes	
Statistical Modeling		
STAT 212	Principles of Study Design	
STAT 301	Mathematical Statistics and Modeling I	
STAT 302	Mathematical Statistics and Modeling II	
STAT 325	Statistical Collaboration I	
STAT 412	Advanced Statistical Design	
STAT 414	Introduction to Survey Sampling	
STAT 432	Introduction to Spatial Statistics	
STAT 443	Statistical Analysis of Genomics Data	
STAT 450	Introduction to Regression Analysis	
STAT 462	Introduction to Mathematical Statistics I: Distribution Theory	
STAT 463	Introduction to Mathematical Statistics II: Statistical Inference	
STAT 464	Model Selection and Prediction	
STAT 474	Introduction to Nonparametric Statistics	
STAT 475	Introduction to Categorical Data Analysis	
STAT 478	Introduction to Time Series Analysis	
STAT 486	Introduction to Bayesian Analysis	
PLAS 420	Bioinformatics Applications in Agriculture	
SOCI 465	Survey Design and Analysis	
Applied Computing: Journalism and Humanities		
ADPR 358	UX/UI Design	

HIST 461	Geospatial Approaches in Digital Humanities and Social Sciences	
HIST 470	Digital History	
JOUR 307	Data Journalism	
JOUR 407	Data Visualization	
NSST 376	Analysis for the National Security Establishment	
SPMC 350	Sports Data Visualization and Analytics	
Applied Computing: Sociology		
SOCI 310A	Applied Sociology: Community-based Research I	
SOCI 310B	Applied Sociology: Community-based Research II	
SOCI 333	Applied Research in Public Opinion	
SOCI 362	Ethics and the Responsible Conduct of Research	
SOCI 407	Strategies of Social Research: Qualitative Methods	
SOCI 430	Advanced Social Network Analysis	
SOCI 465	Survey Design and Analysis	
Applied Computing: Natural Resources		
NRES 218	Introduction to Geospatial Technologies	
NRES 415	GIS for Agriculture and Natural Resources	
NRES 418 / GEOG 418	Introduction to Remote Sensing	
AECN 401	Advanced Farm Management and Linear Programming	
AECN 436	Commodity Price Forecasting	
AGST 433	Equipment and Tractor Testing	
PLAS 420	Bioinformatics Applications in Agriculture	
PLAS 431 / AGEN 431 / AGST 431	Site-specific Crop Management	
Credit Hours Subtotal:		15

Additional Major Requirements
Grade Rules
C- and D Grades
A grade of C or above is required for all courses in the major.

Pass/No Pass
No course taken Pass/No Pass will be counted toward the major, unless offered exclusively with a grade option of Pass/No Pass.

PLEASE NOTE
This document represents a sample 4-year plan for degree completion with this major. Actual course selection and sequence may vary and should be discussed individually with your college or department academic advisor. Advisors also can help you plan other experiences to enrich your undergraduate education such as internships, education abroad, undergraduate research, learning communities, and service learning and community-based learning.

Data Science (B.S.)