

DATA SCIENCE (ENGR)

Description

The data science major prepares students with skills and competency in data analysis and interpretation, algorithm design and implementation, and helps them develop aptitudes for interdisciplinary problem-solving. The interdisciplinary 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 our digital age.

Students can select a major in data science through one of three colleges: Arts and Sciences (Department of Mathematics), Engineering (School of Computing), or Agricultural Science and Natural Resources (Department of Statistics). Students in the College of Engineering (COE) will have the opportunity to investigate and learn about the various aspects of data science from data collection to data visualization, from foundations of computational methodologies to software and hardware applications in data science. In particular, students in the COE track will have a year-long senior capstone and a practicum to enrich their experience in building Data Science solutions and working with research and development in data science. The data science program offers flexibility for non-engineering students to earn a dual degree in data science and their chosen discipline's degree program. In addition, students may choose to add a minor that both complements and enhances the data science major.

College Requirements

College Admission

College Entrance Requirements

Students must have high school credit for (one unit is equal to one high school year):

1. Mathematics – 4 units: 2 of algebra, 1 of geometry, and 1 of precalculus and trigonometry
2. English – 4 units
3. Natural sciences – 3 units that must include 1 unit of physics and 1 unit of chemistry (chemistry requirement waived for students in construction management or computer science)
4. Foreign language – 2 units of a single foreign language
5. Social studies – 3 units
6. Students having a composite ACT score of 28 or greater (or equivalent SAT score) will be admitted to the College of Engineering even if they lack any one of the following: trigonometry, chemistry, or physics. Students without test scores who are missing a full unit of trigonometry/pre-calculus/calculus or chemistry or physics will be evaluated through College Review.
7. Students having an ACT score of 19 or less in English (or equivalent SAT score) or a grade lower than B in high school English, must take ENGL 150 Writing and Inquiry or ENGL 151 Writing and Argument.

A total of 16 units is required for admission.

Engineering requires that student performance meet one of the following standards: composite ACT of 24, SAT of 1180, ACT Math subscore of 24, SAT Math subscore of 580, or a 3.5 cumulative GPA.

Any domestic first-year student who does not gain admission to Engineering but does gain admission to the University of Nebraska-

Lincoln (UNL) will be reviewed through College Review. College Review is conducted through the College Review Committee which considers factors beyond standardized testing. Any first-year student who is not admitted through college review is placed in Pre-Engineering (PENG) with the Exploratory and Pre-Professional Advising Center (Explore Center). Students in the Explore Center can transfer to the College of Engineering once college admission requirements are met.

Students for whom English is not their language of nurture must meet the minimum English proficiency requirements of the University.

Students who lack entrance units may complete precollege training by Independent Study through the University of Nebraska–Lincoln Office of On-line and Distance Education, in summer courses, or as a part of their first or second semester course loads while in the Explore Center or other colleges at UNL.

Students should consult their advisor, their department chair, or Engineering Student Services (ESS) if they have questions on current policies.

Other Admission Requirements

Students who transfer to the University of Nebraska–Lincoln from other accredited colleges or universities and wish to be admitted to the College of Engineering (COE) must meet COE first-year student entrance requirements, have a minimum cumulative GPA of 2.5, and be calculus-ready. Students not meeting either of these requirements must enroll in the Explore Center or another University college until they meet COE admission requirements. Students transferring from UNO, UNL, or UNK to the College of Engineering must be in good academic standing with their institution.

The COE accepts courses for transfer for which a C or better grade was received. Although the University of Nebraska–Lincoln accepts D grades from the University of Nebraska Kearney and the University of Nebraska Omaha, not all majors in the COE accept such low grades. Students must conform to the requirements of their intended major and, in any case, are strongly encouraged to repeat courses with a grade of C- or less.

Students who were previously admitted to COE and are returning to the College of Engineering must demonstrate a cumulative GPA of 2.5 to be readmitted to COE.

College Degree Requirements

Grade Rules

Grade Appeals

In the event of a dispute involving any college policies or grades, the student should appeal to their instructor, and appropriate department chair or school director (in that order). If a satisfactory solution is not achieved, the student may appeal their case through the College Academic Appeals Subcommittee.

Catalog Rule

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted 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 Nebraska in the College of Engineering. Students must complete all degree requirements from a single catalog year. The catalog which a student follows for

degree requirements may not be more than 10 years old at the time of graduation.

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 the student's College of Engineering academic advising team (e.g., ESS professional advisor and the chief faculty advisor for the student's declared degree program). #The chief faculty advisor has the final authority for this decision. Eligibility is based on a) enrollment in a community college during the catalog year the student wishes to utilize, b) maintaining continuous enrollment of at least 12 credit hours per semester at the previous institution for at least 2 semesters, and c) continuous enrollment at the University of Nebraska-Lincoln within 1 calendar year from the student's last term at the previous institution. #Students must complete all degree requirements from a single catalog year and within the timeframe 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

Complete the data science foundations

Core Requirements

Data Science Foundations

CSCE 155T	Computer Science I: Informatics Focus ¹	3
CSCE 311	Data Structures and Algorithms for Informatics ²	3
CSCE 320	Data Analysis	3
MATH 104	Applied Calculus (ACE 3)	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
STAT 101	Introduction to Data	3
STAT 102	Principles of Statistical Analysis	3
Credit Hours Subtotal:		24-27

Data Science Professional Experience ³

CSCE 386	Practice and Professional Development: Design and Implementation	3
	or CSCE 492 Special Topics in Computer Science	
	or CSCE 495 Internship in Computing Practice	

CSCE 486	Computer Science Professional Development (ACE 8) ⁴	3
	or CSCE 486H Honors Computer Science Professional Development	
CSCE 487	Computer Science Senior Design Project (ACE 10)	3
	or CSCE 493A Interdisciplinary Capstone	
	or MATH 435 Math in the City	
Credit Hours Subtotal:		9

¹ CSCE 155T *is recommended, but any of the CSCE 155 courses may be used.*

² CSCE 311 *is recommended, but CSCE 310 may be used.*

³ CSCE 492 *may be used only if topic is related to Data Science.*

⁴ *May be replaced by a student's second major's capstone course.*

Specific Major Requirements

Data Science Focus Areas

Select 4 courses from 2 of the focus areas below for at least 12 credit hours	12
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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

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

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
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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

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
SOCI 465	Survey Design and Analysis
PLAS 420	Bioinformatics Applications in Agriculture

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

Applied Computing: Journalism & 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
<i>Applied Computing: Natural Resources</i>	
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
PLAS 420	Bioinformatics Applications in Agriculture
PLAS 431 / AGEN 431 / AGST 431	Site-specific Crop Management
AGST 433	Equipment and Tractor Testing
Credit Hours Subtotal:	12

Ancillary Requirements**BREADTH COURSES - ARTS, HUMANITIES AND SOCIAL SCIENCES**

Fulfilled by the completion of six (6) credit hours in Arts, Humanities and Social Sciences courses. At least three (3) credit hours from courses certified as "Diversity in US Communities."	6
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Select from a set of approved courses in Anthropology, Art History, Classics, Communication Studies, Economics, English, History, Ethnic Studies, Geography, Foreign Languages & Literature, Philosophy, Political Science, Psychology, Religious Studies, Sociology, and Women's and Gender Studies as listed in the degree audit.

Credit Hours Subtotal:	6
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TECHNICAL WRITING

JGEN 200	Technical Communication I (ACE 1) or BSAD 220H Honors Business Writing	3
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Credit Hours Subtotal:	3
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SCIENCE (ACE 4)

Select 6 credit hours of courses intended for science or engineering majors including at least one laboratory. Acceptable disciplines and courses are (not an exhaustive list):	6
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Chemistry

CHEM 109A & CHEM 109L	General Chemistry I and General Chemistry I Laboratory ¹	3
CHEM 110A & CHEM 110L	General Chemistry II and General Chemistry II Laboratory ¹	3
CHEM 221A & CHEM 221L	Elementary Quantitative Analysis and Elementary Quantitative Analysis Laboratory ¹	3
CHEM 113A & CHEM 113L	Fundamental Chemistry I and Fundamental Chemistry I Laboratory ¹	3
CHEM 114	Fundamental Chemistry II	3

Physics and Astronomy

PHYS 141	Elementary General Physics I ¹	3
PHYS 142	Elementary General Physics II ¹	3
PHYS 211	General Physics I	3

PHYS 212	General Physics II
PHYS 221	General Physics Laboratory I ¹
PHYS 222	General Physics Laboratory II ¹
PHYS 213	General Physics III
PHYS 223	General Physics Laboratory III ¹
ASTR 204	Introduction to Astronomy and Astrophysics
ASTR 224	Astronomy and Astrophysics Laboratory ¹

Biological Sciences

BIOS 111	Introduction to Microbiology and Human Health ¹
BIOS 205	Genetics, Molecular and Cellular Biology Laboratory ¹
BIOS 206	General Genetics
BIOS 207	Ecology and Evolution ¹
LIFE 120 & LIFE 120L	Fundamentals of Biology I and Fundamentals of Biology I laboratory ¹
LIFE 121 & LIFE 121L	Fundamentals of Biology II and Fundamentals of Biology II Laboratory ¹

Earth and Atmospheric Sciences

GEOG 155	Elements of Physical Geography ¹
GEOL 101	Dynamic Earth ¹
GEOL 103	Earth Through Time ¹
GEOL 410	Geochemistry
METR 100	Weather and Climate ¹
METR 205	Introduction to Atmospheric Science ¹
METR 370	Applied Climatology

Anthropology

ANTH 242	Introduction to Biological Anthropology
ANTH 242L	Introduction to Biological Anthropology Laboratory ¹

Credit Hours Subtotal:	6
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ACE Requirements

Select one course each from ACE outcomes 2, 5, 6, 7, and 9	15
Credit Hours Subtotal:	15

¹ Indicates a lab course or that a lab is included with the course.

Course Level Requirement

Thirty (30) of the 120 credit hours must be in courses numbered at the 300 or 400 level. Of those 30 hours, 15 credit hours 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 half of their major coursework, including 6 credit hours at the 300 or 400 level in their major, and 15 of the 30 credit 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.

Additional Major Requirements**Grade Rules****C- and D Grades**

A grade of C or above is required for all courses in the major (core requirements and focus areas), excluding ancillary courses.

Pass/No Pass

No course taken Pass/No Pass will be counted toward the major (core requirements and focus areas), unless offered exclusively with a grade option of Pass/No Pass.