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 students to earn a dual degree in Data Science and their chosen discipline's degree program. However, students who do not double major are required to add a minor that both complements and enhances the Data Science major.

College Requirements

College Admission

College Entrance Requirements
Students must meet both the University and College of Engineering entrance requirements. The following includes both the University and College of Engineering 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 for Change.

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**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>CSCE 10</td>
<td>Introduction to CSE</td>
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<tr>
<td>or ENGR 10</td>
<td>Freshman Engineering Seminar</td>
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</tr>
<tr>
<td>CSCE 155T</td>
<td>Computer Science I: Informatics Focus</td>
<td>3</td>
</tr>
<tr>
<td>CSCE 311</td>
<td>Data Structures and Algorithms for Informatics</td>
<td>3</td>
</tr>
<tr>
<td>or RAIK 283H</td>
<td>Honors: Software Engineering III</td>
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</tr>
<tr>
<td>CSCE 320</td>
<td>Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>or RAIK 370H</td>
<td>Honors: Data and Models II: Data Science Fundamentals</td>
<td></td>
</tr>
<tr>
<td>MATH 104</td>
<td>Applied Calculus (ACE 3)</td>
<td>3-5</td>
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<tr>
<td>or MATH 106</td>
<td>Calculus I</td>
<td></td>
</tr>
<tr>
<td>MATH 203</td>
<td>Contemporary Mathematics</td>
<td>3-4</td>
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<tr>
<td>or MATH 107</td>
<td>Calculus II</td>
<td></td>
</tr>
<tr>
<td>MATH 315</td>
<td>Linear Algebra for Data Science</td>
<td>3</td>
</tr>
</tbody>
</table>

Credit Hours Subtotal: 18-21

### Statistics

Select one of the following: 6

**Option 1**

| STAT 218 | Introduction to Statistics or STAT 380 Statistics and Applications or 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: 12

### Data Science Professional Experience

| 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 B) | 3 |
| or CSCE 486H | Honors Computer Science Professional Development | |

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

#### 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

<p>| SOCI 310A | Applied Sociology: Community-based Research I | |
| SOCI 310B | Applied Sociology: Community-based Research II | |
| SOCI 333 | Applied Research in Public Opinion | |</p>
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>SOCI 362</td>
<td>Ethics and the Responsible Conduct of Research</td>
</tr>
<tr>
<td>SOCI 407</td>
<td>Strategies of Social Research: Qualitative Methods</td>
</tr>
<tr>
<td>SOCI 430</td>
<td>Advanced Social Network Analysis</td>
</tr>
<tr>
<td>SOCI 465</td>
<td>Survey Design and Analysis</td>
</tr>
<tr>
<td>CSCE 361</td>
<td>Software Engineering</td>
</tr>
<tr>
<td>CSCE 378</td>
<td>Human-Computer Interaction</td>
</tr>
<tr>
<td>CSCE 403H / RAIK 403H</td>
<td>Honors: RAIK Design Studio III and Honors: RAIK Design Studio IV &amp; CSCE 404H / RAIK 404H</td>
</tr>
<tr>
<td>CSCE 412</td>
<td>Data Visualization</td>
</tr>
<tr>
<td>CSCE 413</td>
<td>Database Systems</td>
</tr>
<tr>
<td>CSCE 436</td>
<td>Advanced Embedded Systems</td>
</tr>
<tr>
<td>CSCE 438</td>
<td>Internet of Things</td>
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<tr>
<td>CSCE 458</td>
<td>Molecular and Nanoscale Communication</td>
</tr>
<tr>
<td>CSCE 459</td>
<td>Wireless Communication Networks</td>
</tr>
<tr>
<td>STAT 212</td>
<td>Principles of Study Design</td>
</tr>
<tr>
<td>STAT 301</td>
<td>Mathematical Statistics and Modeling I</td>
</tr>
<tr>
<td>STAT 302</td>
<td>Mathematical Statistics and Modeling II</td>
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<td>Statistical Collaboration I</td>
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<td>STAT 486</td>
<td>Introduction to Bayesian Analysis</td>
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<td>MATH 208</td>
<td>Calculus III</td>
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<td>MATH 221</td>
<td>Differential Equations</td>
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<td>Geospatial Approaches in Digital Humanities and Social Sciences</td>
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<td>PLAS 420</td>
<td>Bioinformatics Applications in Agriculture</td>
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<tr>
<td>PLAS 431 / AGST 431</td>
<td>Site-specific Crop Management</td>
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</tbody>
</table>

**Credit Hours Subtotal:** 12

### Ancillary Requirements

#### Breadth Course- Arts, Humanities, & Social Sciences

Complete 3 credits from ACE 5, 6, or 7 approved courses

**Credit Hours Subtotal:** 3

#### Breadth Course- Global Awareness/Human Diversity
Complete 3 credits from ACE 9 approved courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>JGEN 200</td>
<td>Technical Communication I (ACE 1)</td>
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Credit Hours Subtotal: 3

**TECHNICAL WRITING**

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<tr>
<td>JGEN 200</td>
<td>Technical Communication I (ACE 1)</td>
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Credit Hours Subtotal: 3

**SCIENCE (ACE 4)**

Select 8 credit hours of courses intended for science or engineering majors including at least one laboratory. Acceptable disciplines and courses are (not an exhaustive list):

**Chemistry**

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<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>CHEM 109A &amp; CHEM 109L</td>
<td>General Chemistry I and General Chemistry I Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 110A &amp; CHEM 110L</td>
<td>General Chemistry II and General Chemistry II Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 113A &amp; CHEM 113L</td>
<td>Fundamental Chemistry I and Fundamental Chemistry I Laboratory</td>
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</tr>
<tr>
<td>CHEM 114</td>
<td>Fundamental Chemistry II</td>
<td></td>
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<tr>
<td>CHEM 221A &amp; CHEM 221L</td>
<td>Elementary Quantitative Analysis and Elementary Quantitative Analysis Laboratory</td>
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**Physics and Astronomy**

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<th>Title</th>
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<tr>
<td>ASTR 204</td>
<td>Introduction to Astronomy and Astrophysics</td>
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<tr>
<td>ASTR 224</td>
<td>Astronomy and Astrophysics Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 141</td>
<td>Physics for Life Sciences I</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 142</td>
<td>Physics for Life Sciences II</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 211</td>
<td>General Physics I</td>
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</tr>
<tr>
<td>PHYS 212</td>
<td>General Physics II</td>
<td></td>
</tr>
<tr>
<td>PHYS 221</td>
<td>General Physics Laboratory I</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 222</td>
<td>General Physics Laboratory II</td>
<td>1</td>
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<tr>
<td>PHYS 213</td>
<td>General Physics III</td>
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<tr>
<td>PHYS 223</td>
<td>General Physics Laboratory III</td>
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</table>

**Biological Sciences**

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<tbody>
<tr>
<td>BIOS 205</td>
<td>Genetics, Molecular and Cellular Biology Laboratory</td>
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<tr>
<td>BIOS 206</td>
<td>General Genetics</td>
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<tr>
<td>BIOS 207</td>
<td>Ecology and Evolution</td>
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<tr>
<td>BIOS 111</td>
<td>Introduction to Microbiology and Human Health</td>
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<td>LIFE 120 &amp; LIFE 120L</td>
<td>Fundamentals of Biology I and Fundamentals of Biology I Laboratory</td>
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</tr>
<tr>
<td>LIFE 121 &amp; LIFE 121L</td>
<td>Fundamentals of Biology II and Fundamentals of Biology II Laboratory</td>
<td>1</td>
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**Earth and Atmospheric Sciences**

<table>
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<th>Credit Hours</th>
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<tbody>
<tr>
<td>GEOG 155</td>
<td>Elements of Physical Geography</td>
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</tr>
<tr>
<td>GEOL 101</td>
<td>Dynamic Earth</td>
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<tr>
<td>GEOL 103</td>
<td>Earth Through Time</td>
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<tr>
<td>GEOL 410</td>
<td>Geochemistry</td>
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<tr>
<td>METR 100</td>
<td>Weather and Climate</td>
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</tr>
<tr>
<td>METR 205</td>
<td>Introduction to Atmospheric Science</td>
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</tr>
<tr>
<td>METR 370</td>
<td>Applied Climatology</td>
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**Anthropology**

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<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>ANTH 242</td>
<td>Introduction to Biological Anthropology</td>
<td></td>
</tr>
<tr>
<td>ANTH 242L</td>
<td>Introduction to Biological Anthropology Laboratory</td>
<td>1</td>
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</tbody>
</table>

Credit Hours Subtotal: 8

**ACE Requirements**

Select one course each from ACE outcomes 2, 5, 6, 7, and 9

Credit Hours Subtotal: 15

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

2 JGEN 200 may be replaced by any ACE 1 course.

**Minor Requirement**

Complete at least one minor or a second major.

**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.

**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 17 hours of their major coursework 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.