



Twin Cities Campus

Data Science B.S.-ARCHIVED

Computer Science and Engineering Administration

College of Science and Engineering

• **Students will no longer be accepted into this program after Spring 2021. Program requirements below are for current students only.**

- Program Type: Baccalaureate
- Requirements for this program are current for Spring 2021
- Required credits to graduate with this degree: 120
- Required credits within the major: 94

A data scientist is a person who should be able to leverage existing data sources and create new ones as needed in order to extract meaningful information and actionable insights. These insights can be used to drive business decisions and changes intended to achieve business goals.

This is done through business domain expertise, effective communication and results interpretation, and utilization of any and all relevant statistical techniques, programming languages, software packages and libraries, data infrastructure, and so on.

The degree prepares students for work in various industrial, governmental, and business positions. Graduates will be able to:

- * Conduct research on open-ended industry or organization questions
- * Extract large volumes of data from both internal and external sources
- * Clean and remove irrelevant data information from usable data
- * Analyze data for weaknesses, trends, and/or opportunities
- * Create algorithms to solve problems and build new automation tools
- * Effectively communicate findings to management

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Admission Requirements

Students must complete 5 courses before admission to the program.

Freshman and transfer students are usually admitted to pre-major status before admission to this major

For information about University of Minnesota admission requirements, visit the [Office of Admissions website](#).

Required prerequisites

Mathematics Core

Calculus I

- [MATH 1371](#) - CSE Calculus I [MATH] (4.0 cr)
- or [MATH 1271](#) - Calculus I [MATH] (4.0 cr)
- or [MATH 1571H](#) - Honors Calculus I [MATH] (4.0 cr)

Calculus II

- [MATH 1372](#) - CSE Calculus II (4.0 cr)
- or [MATH 1272](#) - Calculus II (4.0 cr)
- or [MATH 1572H](#) - Honors Calculus II (4.0 cr)

Computer Science Introductory Core

Data Science Sequences

Preferred Data Science Sequence

- [CSCI 1133](#) - Introduction to Computing and Programming Concepts (4.0 cr)
- [CSCI 2081](#) - Introduction to Software Development (4.0 cr)

or Alternative Sequence Options

In order to maximize course overlap, it is recommended that double majors in Computer Science and Data Science pursue one of the following sequences in place of the Data Science Sequence. CSCI 2081 cannot be used in the Computer Science programs.

- [CSCI 1133](#) - Introduction to Computing and Programming Concepts (4.0 cr)
- [CSCI 1933](#) - Introduction to Algorithms and Data Structures (4.0 cr)
- [CSCI 3081W](#) - Program Design and Development [WI] (4.0 cr)



or [CSCI 1103](#) - Introduction to Computer Programming in Java (4.0 cr)
[CSCI 1913](#) - Introduction to Algorithms, Data Structures, and Program Development (4.0 cr)
[CSCI 3081W](#) - Program Design and Development [WI] (4.0 cr)
or [CSCI 1113](#) - Introduction to C/C++ Programming for Scientists and Engineers (4.0 cr)
[CSCI 1913](#) - Introduction to Algorithms, Data Structures, and Program Development (4.0 cr)
[CSCI 3081W](#) - Program Design and Development [WI] (4.0 cr)

Statistics Core

[STAT 3021](#) - Introduction to Probability and Statistics (3.0 cr)

General Requirements

All students are required to complete general University and college requirements including writing and liberal education courses. For more information about University-wide requirements, see the [liberal education requirements](#). Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

Program Requirements

All freshmen in the College of Science and Engineering must complete CSE 1001: First-Year Experience.

At least 33 upper-division credits in the major must be taken at the University of Minnesota Twin Cities campus.

Science Core

Physics I

[PHYS 1301W](#) - Introductory Physics for Science and Engineering I [PHYS, WI] (4.0 cr)
or [PHYS 1401V](#) - Honors Physics I [PHYS, WI] (4.0 cr)

Second Science Options

[PHYS 1302W](#) - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
or [ESCI 2201](#) - Solid Earth Dynamics (4.0 cr)
or [GCD 3022](#) - Genetics (3.0 cr)
or [PHYS 1402V](#) - Honors Physics II [PHYS, WI] (4.0 cr)
or [PSY 3011](#) - Introduction to Learning and Behavior (3.0 cr)
or [CHEM 1061](#) - Chemical Principles I [PHYS] (3.0 cr)
[CHEM 1065](#) - Chemical Principles I Laboratory [PHYS] (1.0 cr)
or [CHEM 1071H](#) - Honors Chemistry I [PHYS] (3.0 cr)
[CHEM 1075H](#) - Honors Chemistry I Laboratory [PHYS] (1.0 cr)
or [CHEM 1062](#) - Chemical Principles II [PHYS] (3.0 cr)
[CHEM 1066](#) - Chemical Principles II Laboratory [PHYS] (1.0 cr)
or [CHEM 1072H](#) - Honors Chemistry II [PHYS] (3.0 cr)
[CHEM 1076H](#) - Honors Chemistry II Laboratory [PHYS] (1.0 cr)

Data Science Core

[CSCI 4707](#) - Practice of Database Systems (3.0 cr)
[STAT 3301](#) - Regression and Statistical Computing (4.0 cr)
[STAT 4051](#) - Statistical Machine Learning I (4.0 cr)
[IE 3013](#) - Optimization for Machine Learning (4.0 cr)
[IE 5533](#) - Operations Research for Data Science (3.0 cr)
[WRIT 3562W](#) - Technical and Professional Writing [WI] (4.0 cr)
[DSCI 4093](#) - Data Science Senior Project Directed Study (4.0 cr)

Discrete Structures & Algorithms

[CSCI 3041](#) - Introduction to Discrete Structures and Algorithms (4.0 cr)
or In order to maximize course overlap, it is recommended that double majors in Computer Science and Data Science pursue the following sequences in place of the Data Science Sequence. CSCI 3041 cannot be used in the Computer Science programs.
[CSCI 2011](#) - Discrete Structures of Computer Science (4.0 cr)
[CSCI 4041](#) - Algorithms and Data Structures (4.0 cr)

Systems and Systems Programming

[CSCI 3061](#) - Introduction to Computer Systems (4.0 cr)
or In order to maximize course overlap, it is recommended that double majors in Computer Science and Data Science pursue the following sequences in place of the Data Science Sequence. CSCI 3061 cannot be used in the Computer Science programs.
[CSCI 2021](#) - Machine Architecture and Organization (4.0 cr)
[CSCI 4061](#) - Introduction to Operating Systems (4.0 cr)

Multivariable Calculus

[MATH 2374](#) - CSE Multivariable Calculus and Vector Analysis (4.0 cr)
or [MATH 2263](#) - Multivariable Calculus (4.0 cr)



or [MATH 2573H](#) - Honors Calculus III (4.0 cr)

Linear Algebra

[CSCI 2033](#) - Elementary Computational Linear Algebra (4.0 cr)

or [MATH 2142](#) - Elementary Linear Algebra (4.0 cr)

or Students who complete MATH 2243/2373/2471/2574H/3593H AND MATH 4242 qualify for a four-credit waiver in the Data Science Technical Electives area. Students will need to contact a Departmental Advisor to request this waiver after MATH 4242 is completed.

[MATH 4242](#) - Applied Linear Algebra (4.0 cr)

[MATH 2243](#) - Linear Algebra and Differential Equations (4.0 cr)

or [MATH 2373](#) - CSE Linear Algebra and Differential Equations (4.0 cr)

or [MATH 2471](#) - UM Talented Youth Mathematics Program--Calculus II, Second Semester [MATH] (2.0 cr)

or [MATH 2574H](#) - Honors Calculus IV (4.0 cr)

or [MATH 3593H](#) - Honors Mathematics II (5.0 cr)

Machine Learning, Data Mining, or Statistical Learning

[CSCI 5521](#) - Machine Learning Fundamentals (3.0 cr)

or [CSCI 5523](#) - Introduction to Data Mining (3.0 cr)

or [STAT 4052](#) - Statistical Machine Learning II (4.0 cr)

Theory of Statistics

[STAT 5102](#) - Theory of Statistics II (4.0 cr)

Theory of Statistics I options

[STAT 5101](#) - Theory of Statistics I (4.0 cr)

or [MATH 5651](#) - Basic Theory of Probability and Statistics (4.0 cr)

Approved Data Science Major Technical Electives

Students can take any approved data science technical electives from the following list to satisfy the minimum 18 credits required. Unique courses from CSCI, EE, IE, Math, or STAT with titles similar to independent study, directed research, special topics, honors thesis, or senior design can be approved for use as major technical electives if related to the study of data science with Director of Undergraduate Studies approval.

Approved Data Science Major Technical Elective Options

Take 18 or more credit(s) from the following:

- [CSCI 4131](#) - Internet Programming (3.0 cr)
- [CSCI 4271W](#) - Development of Secure Software Systems [WI] (4.0 cr)
- [CSCI 5105](#) - Introduction to Distributed Systems (3.0 cr)
- [CSCI 5115](#) - User Interface Design, Implementation and Evaluation (3.0 cr)
- [CSCI 5117](#) - Developing the Interactive Web (3.0 cr)
- [CSCI 5123](#) - Recommender Systems (3.0 cr)
- [CSCI 5125](#) - Collaborative and Social Computing (3.0 cr)
- [CSCI 5271](#) - Introduction to Computer Security (3.0 cr)
- [CSCI 5302](#) - Analysis of Numerical Algorithms (3.0 cr)
- [CSCI 5304](#) - Computational Aspects of Matrix Theory (3.0 cr)
- [CSCI 5451](#) - Introduction to Parallel Computing: Architectures, Algorithms, and Programming (3.0 cr)
- [CSCI 5461](#) - Functional Genomics, Systems Biology, and Bioinformatics (3.0 cr)
- [CSCI 5481](#) - Computational Techniques for Genomics (3.0 cr)
- [CSCI 5512](#) - Artificial Intelligence II (3.0 cr)
- [CSCI 5525](#) - Machine Learning: Analysis and Methods (3.0 cr)
- [CSCI 5561](#) - Computer Vision (3.0 cr)
- [CSCI 5609](#) - Visualization (3.0 cr)
- [CSCI 5708](#) - Architecture and Implementation of Database Management Systems (3.0 cr)
- [CSCI 5715](#) - From GPS, Google Maps, and Uber to Spatial Data Science (3.0 cr)
- [CSCI 5751](#) - Big Data Engineering and Architecture (3.0 cr)
- [CSCI 5801](#) - Software Engineering I (3.0 cr)
- [CSCI 5802](#) - Software Engineering II (3.0 cr)
- [EE 4541](#) - Digital Signal Processing (3.0 cr)
- [EE 5239](#) - Introduction to Nonlinear Optimization (3.0 cr)
- [EE 5251](#) - Optimal Filtering and Estimation (3.0 cr)
- [EE 5351](#) - Applied Parallel Programming (3.0 cr)
- [EE 5355](#) - Algorithmic Techniques for Scalable Many-core Computing (3.0 cr)
- [IE 3011](#) - Optimization Models and Methods (4.0 cr)
- [IE 5012](#) - Discrete Optimization Methods and Applications (4.0 cr)
- [IE 5111](#) - Systems Engineering I (2.0 cr)
- [IE 5113](#) - Systems Engineering II (4.0 cr)
- [IE 5531](#) - Engineering Optimization I (4.0 cr)
- [IE 5541](#) - Project Management (4.0 cr)
- [IE 5545](#) - Decision Analysis (4.0 cr)
- [IE 5553](#) - Simulation (4.0 cr)
- [IE 5561](#) - Analytics and Data-Driven Decision Making (4.0 cr)
- [MATH 4242](#) - Applied Linear Algebra (4.0 cr)



- [MATH 4428](#) - Mathematical Modeling (4.0 cr)
- [MATH 5467](#) - Introduction to the Mathematics of Image and Data Analysis (4.0 cr)
- [MATH 5652](#) - Introduction to Stochastic Processes (4.0 cr)
- [STAT 4893W](#) - Consultation and Communication for Statisticians [WI] (3.0 cr)
- [STAT 5201](#) - Sampling Methodology in Finite Populations (3.0 cr)
- [STAT 5401](#) - Applied Multivariate Methods (3.0 cr)
- [STAT 5421](#) - Analysis of Categorical Data (3.0 cr)
- [STAT 5511](#) - Time Series Analysis (3.0 cr)
- [STAT 5601](#) - Nonparametric Methods (3.0 cr)
- [STAT 5931](#) - Topics in Statistics (3.0 cr)
- [CSCI 4511W](#) - Introduction to Artificial Intelligence [WI] (4.0 cr)
or [CSCI 5511](#) - Artificial Intelligence I (3.0 cr)

Upper Division Writing Intensive within the major

Students are required to take one upper division writing intensive course within the major. If that requirement has not been satisfied within the core major requirements, students must choose one course from the following list. Some of these courses may also fulfill other major requirements.

Upper Division Writing Intensive within the major

Take 0 - 1 course(s) from the following:

- [CSCI 4271W](#) - Development of Secure Software Systems [WI] (4.0 cr)
- [CSCI 4511W](#) - Introduction to Artificial Intelligence [WI] (4.0 cr)
- [CSCI 4970W](#) - Advanced Project Laboratory [WI] (3.0 cr)
- [STAT 4893W](#) - Consultation and Communication for Statisticians [WI] (3.0 cr)
- [WRIT 3562W](#) - Technical and Professional Writing [WI] (4.0 cr)