

DATA SCIENCE MINOR

Students minoring in data science receive exposure to computational and applied statistical techniques. This minor provides a strong foundation for graduate work and academic preparation in the area.

Requirements for the Minor in Data Science

Students take 2 foundational courses, 4 core courses (the 3 Data Science sequence courses and Data Visualization (STAT 302-0)), and 1 approved elective (p. 1). For details see course lists, below.

Course	Title
Minor Requirements (7 units)	
<i>2 foundational courses:</i>	
STAT 201-0 or COMP_SCI 110-0	Introduction to Programming for Data Science Introduction to Computer Programming
(students who do not take STAT 201-0 are responsible for independently learning content not covered in alternative course) ¹	
STAT 202-0 or STAT 210-0 or STAT 232-0	Introduction to Statistics and Data Science Introduction to Probability and Statistics Applied Statistics
or approved introductory statistics course from another department	
<i>4 data science core courses:</i>	
STAT 301-1 & STAT 301-2 & STAT 301-3	Data Science 1 with R and Data Science 2 with R and Data Science 3 with R
or	
STAT 303-1 & STAT 303-2 & STAT 303-3	Data Science 1 with Python and Data Science 2 with Python and Data Science 3 with Python
NOTE! Students may receive credit for only one Data Science sequence: either Data Science with R (301 sequence), or Data Science with Python (303 sequence)	
STAT 302-0	Data Visualization

¹ 1 approved elective course (see lists below)

¹ Lists of topics not covered in substitute courses can be found on the department website (<https://statistics.northwestern.edu/undergraduate/>).

Courses used to fulfill the requirements for the minor in data science may not be used to fulfill the requirements for another major/minor except where permitted by Weinberg College double-counting rules (see FAQ (<https://weinberg.northwestern.edu/undergraduate/degree/post-spring-2023-degree/double-counting-faq.html>)). When necessary (for example when a student plans to complete a major in statistics and a minor in data science), students can consult the Director of Data Science in the Department of Statistics and Data Science (<https://www.statistics.northwestern.edu/>) about selection of replacement course(s) to satisfy the credit requirements of the data science minor.

Approved Elective Courses for the Data Science Minor

Students choose 1 course from any of the fields below. For updates please refer to department website list of Data Science Minor Approved Electives (https://statistics.northwestern.edu/undergraduate/data_science_minor/dsminor_approved_elective.html). Some courses may have prerequisites; check course descriptions for details.

Anthropology

Course	Title
ANTHRO 322-0	Introduction to Archaeology Research Design & Methods
ANTHRO 324-0	Archaeological Survey Methods
ANTHRO 362-0	Advanced Methods in Quantitative Analysis
ANTHRO 389-0	Ethnographic Methods and Analysis

Biological Sciences

Course	Title
BIOL_SCI 323-0	Bioinformatics: Sequence and Structure Analysis
BIOL_SCI 338-0	Modeling Biological Dynamics
BIOL_SCI 341-0	Population Genetics
BIOL_SCI 354-0	Quantitative Analysis of Biology
BIOL_SCI 359-0	Quantitative Experimentation in Biology
BIOL_SCI 378-0	Functional Genomics

Biomedical Engineering

Course	Title
BMD_ENG 311-0	Computational Genomics

Chemical Engineering

Course	Title
CHEM_ENG 379-0	Computational Biology: Analysis and Design of Living Systems

Cognitive Science

Course	Title
COG_SCI 345-0	Presenting Ideas & Data

Communication Studies

Course	Title
COMM_ST 352-0	Social Network Analysis
COMM_ST 355-0	Audience Analysis
COMM_ST 358-0	Algorithms and Society
COMM_ST 371-0	Cultural Analytics

Computer Engineering

Course	Title
COMP_ENG 329-0	The Art of Multicore Concurrent Programming
COMP_ENG 358-0	Introduction to Parallel Computing
COMP_ENG 365-0	Internet-of-things Sensors, Systems, And Applications
COMP_ENG 368-0	Programming Massively Parallel Processors with CUDA

Computer Science

Course	Title
COMP_SCI 214-0	Data Structures & Algorithms
COMP_SCI 217-0	Data Management & Information Processing
COMP_SCI 323-0	Code Analysis and Transformation
COMP_SCI 325-0	Artificial Intelligence Programming
COMP_SCI 331-0	Introduction to Computational Photography
COMP_SCI 333-0	Interactive Information Visualization
COMP_SCI 335-0	Introduction to the Theory of Computation
COMP_SCI 336-0	Design & Analysis of Algorithms
COMP_SCI 337-0	Natural Language Processing
COMP_SCI 339-0	Introduction to Database Systems
COMP_SCI 344-0	Design of Computer Problem Solvers
COMP_SCI 345-0	Distributed Systems
COMP_SCI 347-0	Conversational AI

COMP_SCI 348-0	Introduction to Artificial Intelligence
COMP_SCI 349-0	Machine Learning
COMP_SCI 351-1	Introduction to Computer Graphics
COMP_SCI 351-2	Intermediate Computer Graphics
COMP_SCI 352-0	Machine Perception of Music & Audio
COMP_SCI 367-0	Wireless and Mobile Health: Passive Sensing Data Analytics

Earth and Planetary Science

Course	Title
EARTH 323-0	Seismology and Earth Structure
EARTH 327-0	Geophysical Time Series Analysis
EARTH 340-0	Physics of Weather & Climate
EARTH 343-0	Earth System Modeling
EARTH 353-0	Mathematical Inverse Methods in Earth and Environmental Sciences
EARTH 360-0	Instrumentation and Field Methods
EARTH 361-0	Scientific Programming in Python
EARTH 362-0	Data Analysis for Earth and Planetary Sciences

Economics

Course	Title
ECON 310-1	Microeconomics
ECON 310-2	Microeconomics
ECON 311-0	Macroeconomics
ECON 329-0	Experimental Economics
ECON 330-0	Behavioral Economics
ECON 331-0	Economics of Risk and Uncertainty
ECON 336-0	Analytic Methods for Public Policy Analysis
ECON 380-1	Game Theory
ECON 381-1	Econometrics
ECON 381-2	Econometrics
ECON 383-0	Applied Econometrics

Electrical Engineering

Course	Title
ELEC_ENG 328-0	Information Theory & Learning
ELEC_ENG 331-0	Introduction to Computational Photography
ELEC_ENG 332-0	Introduction to Computer Vision
ELEC_ENG 335-0	Deep Learning Foundations from Scratch
ELEC_ENG 373-0	Deep Reinforcement Learning
ELEC_ENG 375-0	Machine Learning: Foundations, Applications, and Algorithms

Engineering Sciences and Applied Mathematics

Course	Title
ES_APPM 344-0	High Performance Scientific Computing
ES_APPM 346-0	Modeling and Computation in Science & Engineering
ES_APPM 370-1	Introduction to Computational Neuroscience
ES_APPM 375-1	Quantitative Biology I: Experiments, Data, Models, and Analysis
ES_APPM 375-2	Quantitative Biology II: Experiments, Data, Models, and Analysis

Geography

Course	Title
GEOG 341-0	Principles of Cartography
GEOG 343-0	Geographic Information Systems

Global Health Studies

Course	Title
GBL_HLTH 320-0	Qualitative Research Methods in Global Health

Industrial Engineering and Management Sciences

Course	Title
IEMS 308-0	Data Science and Analytics
IEMS 313-0	Foundations of Optimization
IEMS 315-0	Stochastic Models
IEMS 317-0	Discrete Event Systems Simulation
IEMS 340-0	Qualitative Methods in Engineering Systems
IEMS 341-0	Social Networks Analysis
IEMS 351-0	Optimization Methods in Data Science

Integrated Marketing Certificate

Course	Title
IMC 302-0	Research and Data Analytics
IMC 307-0	Digital, Social and Mobile Marketing

Journalism

Course	Title
JOUR 342-1	Knight Lab: Studio
JOUR 377-0	Knight Lab: Data Analysis & Visualization

Linguistics

Course	Title
LING 334-0	Introduction to Computational Linguistics

Mathematics

Course	Title
MATH 306-0	Combinatorics & Discrete Mathematics
MATH 308-0	Graph Theory
MATH 310-1	Probability and Stochastic Processes
MATH 310-2	Probability and Stochastic Processes
MATH 310-3	Probability and Stochastic Processes
MATH 311-1	MENU: Probability and Stochastic Processes
MATH 311-2	MENU: Probability and Stochastic Processes
MATH 311-3	MENU: Probability and Stochastic Processes
MATH 314-0	Probability and Statistics for Econometrics
MATH 366-0	Mathematical Models in Finance
MATH 368-0	Introduction to Optimization
MATH 370-0	Mathematical Logic
MATH 386-1	Econometrics for MMSS
MATH 386-2	Econometrics for MMSS

Music Theory

Course	Title
MUS_THRY 348-0	Corpus Studies

Political Science

Course	Title
POLI_SCI 310-0	Methods of Political Inference
POLI_SCI 312-0	Statistical Research Methods

Psychology

Course	Title
PSYCH 345-0	Presenting Ideas & Data
PSYCH 369-0	Psychological Tests & Measures

PSYCH 380-0	Advanced Statistics & Experimental Design
PSYCH 387-0	Consumer Psychology and Marketing Research

School of Education and Social Policy

Course	Title
SESP 272-0	Field Research Methods
SOC_POL 330-0	Economics of Social Policy
SOC_POL 331-0	Economics of Inequality and Discrimination
SOC_POL 333-0	Economics of Health, Human Capital, and Happiness

Sociology

Course	Title
SOCIO 303-0	Analysis and Interpretation of Social Data
SOCIO 329-0	Field Research and Methods of Data Collection
SOCIO 335-0	Sociology of Rational Decision Making

Statistics and Data Science

Course	Title
STAT 320-1	Statistical Theory & Methods 1
STAT 320-2	Statistical Theory & Methods 2
STAT 320-3	Statistical Theory & Methods 3
STAT 328-0	Causal Inference
STAT 344-0	Statistical Computing
STAT 348-0	Applied Multivariate Analysis
STAT 350-0	Regression Analysis
STAT 351-0	Design and Analysis of Experiments
STAT 352-0	Nonparametric Statistical Methods
STAT 353-0	Advanced Regression
STAT 354-0	Time Series Modeling
STAT 356-0	Hierarchical Linear Models
STAT 357-0	Introduction to Bayesian Statistics
STAT 365-0	Introduction to the Analysis of Financial Data

The Data Science Minor in Relation to Majors

The minor in Data Science can be completed along with any major. The general Weinberg College policies about major/minor pairings apply. Below is clarifying text about how this works with certain majors, and where particular exceptions to general rules are approved.

The Data Science Minor for Students in the Integrated Science Program

Students complete all requirements for the ISP major, and requirements for Data Science minor are modified as follows:

- Introductory Statistics course requirement: STAT 202-0, STAT 210-0, STAT 232-0 or equivalent is **waived**

All other Data Science minor requirements must be met.

The Data Science Minor for Students in the Mathematical Methods in the Social Sciences Program

Students will complete all requirements for the MMSS adjunct major, and requirements for Data Science minor are modified as follows:

- Introductory Statistics course requirement: STAT 202-0, STAT 210-0, STAT 232-0 or equivalent is **waived**

All other Data Science minor requirements must be met.

The Data Science Minor with the Major in Statistics

Students complete all requirements for Statistics major, and requirements for Data Science minor are modified as follows:

- STAT 201-0 (or COMP_SCI 110-0) is replaced with another approved course. In most cases, an introductory calculus course that is necessary for the Statistics major will be used as the replacement.
- STAT 202-0, STAT 210-0, STAT 232-0 or equivalent is replaced with another approved course. In most cases, an introductory calculus course that is necessary for the Statistics major will be used as the replacement.

Note: STAT 301-1,2,3 (Data Science with R), STAT 303-1,2,3 (Data Science with Python), and any 300-level electives being used for the Data Science minor cannot be used to fulfill credit requirements for the Statistics major.

All other Data Science minor requirements must be met.