

# DATA SCIENCE UNDERGRADUATE CERTIFICATE

Please click here (<http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/mathematical-statistical-sciences/>) to see Mathematical and Statistical Sciences department information.

## Introduction

Data scientists will have essential competencies in several areas related to analysis of data. In particular, a data scientist should: have strong programming ability in a language popular in data science (e.g., Python, R, Julia); be able to extract, manipulate, and visualize data; have an understanding of probability and statistics in order to quantify uncertainty; be able to build complex models for finding patterns and explaining data. This certificate should provide students with essential skills for introductory data science.

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## Program Delivery

- This is an on-campus program.

## Declaring This Certificate

Students interested in completing this certificate should complete this form: CLAS Undergraduate Certificate Intent to Declare Form ([https://ucdenver.co1.qualtrics.com/jfe/form/SV\\_2hNYIHqVx0Ta0Dk/](https://ucdenver.co1.qualtrics.com/jfe/form/SV_2hNYIHqVx0Ta0Dk/)), which requests that the certificate be added to your student record. Once added, you will be able to run a certificate degree audit. The certificate degree audit should be used in collaboration with the Certificate Advisor to ensure successful completion of the requirements.

Students should then work with Joshua French ([data.science.advising@ucdenver.edu](mailto:data.science.advising@ucdenver.edu)) – the certificate advisor, to ensure completion of all certificate requirements.

## Completing This Certificate

Students must also complete the CLAS Undergraduate Certificate Completion Verification Form, ([https://ucdenver.co1.qualtrics.com/jfe/form/SV\\_eyPLZl6vVh0wG8K/](https://ucdenver.co1.qualtrics.com/jfe/form/SV_eyPLZl6vVh0wG8K/)) before graduation, in order to confirm completion of their certificate. The certificate advisor will confirm that your certificate has been successfully completed, and will work with campus partners to apply the certificate to your transcript.

Students must fill out the Certificate Completion Form before the deadlines below, to ensure the certificate is applied to your transcript correctly. If you are a non-degree seeking student, please fill out this form in the term in which you intend to complete your certificate.

Spring semester – **April 1**

Summer semester – **July 1**

Fall semester – **November 1**

These program requirements are subject to periodic revision by the academic department, and the College of Liberal Arts and Sciences

reserves the right to make exceptions and substitutions as judged necessary in individual cases. Therefore, the College strongly urges students to consult regularly with their Data Science advisor to confirm the best plans of study before finalizing them.

## General Requirements

Students must satisfy all requirements as outlined below and by the department offering the certificate.

- Click here (<http://catalog.ucdenver.edu/cu-denver/undergraduate/academic-policies-procedures/>) for information about Academic Policies.

## Certificate Requirements

- Students must complete a minimum of 12 credit hours from approved courses.
- Students must complete a minimum of six upper division (3000-level and above) credit hours with CU Denver faculty.
- Students must earn a minimum grade of C- (1.7) in all courses that apply to the certificate and must achieve a minimum cumulative certificate GPA of 2.25. Courses taken using P+/P/F or S/U grading cannot apply to certificate requirements.

Code	Title	Hours
<b>Programming</b>		<b>3</b>
<i>In order to ensure adequate programming skills for data science, students should take a course that develops strong programming skills in a programming language popular in data science (e.g., Python, R, Julia). The list of currently approved courses includes:</i>		
CSCI 1410 & CSCI 1411	Fundamentals of Computing and Fundamentals of Computing Laboratory	
ISMG 4400	Programming Fundamentals with Python	
MATH 1376	Programming for Data Science	
MATH 4650	Numerical Analysis I	
<b>Probability and Statistics</b>		<b>3</b>
<i>In order to ensure that students can accurately quantify the likelihood of various outcomes and quantify uncertainty related to estimation and prediction, students should take a course that covers basic probability and statistics. The list of currently approved courses includes:</i>		
BANA 2010	Business Statistics	
BIOL 3762	Biostatistics	
CSCI 2980	Foundations of Data Science	
CRJU 3150	Statistics for Criminal Justice	
ECON 3811	Statistics with Computer Applications	
MATH 2830	Introductory Statistics	
MATH 3382	Statistical Theory	
MATH 3800	Probability and Statistics for Engineers	
PSYC 2090	Statistics and Research Methods	
<b>Data Management, Manipulation and Visualization</b>		<b>3</b>
<i>In order to ensure that students are able to comfortably work with and visualize data, students should take a course developing skills related to managing, manipulating, and/or visualizing data. The list of currently approved courses includes:</i>		
CSCI 3287	Database System Concepts	
ECON 4030	Data Analysis with SAS	
GEOG 4080	Introduction to GIS	
HIST 4261	Working With Data	

ISMG 2050	Business Problem Solving Tools
ISMG 3050	Intermediate Excel for Business
ISMG 3500	Business Data and Database Management
MATH 3376	Data Wrangling & Visualization

**Data Modeling** 3

*In order to ensure that students are able to build reasonably complex models for explaining or identifying patterns in data, students should take a course that largely focuses on describing the behavior of data (whether synthetic or observed) via tools like simulation, direct model building, association, or a complementary approach. The list of currently approved courses includes:*

BANA 4120	Forecasting Techniques
CSCI 4455	Data Mining
CSCI 4580	Data Science
CSCI 4930	Machine Learning
ECON 4811	Introduction to Econometrics
ELEC 3701	Machine Learning for Engineers
MATH 3301	Introduction to Optimization
MATH 4387	Applied Regression Analysis
MATH 4388	Machine Learning Methods
MATH 4830	Applied Statistics

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**Total Hours** 12

To learn more about the Student Learning Outcomes for this program, please visit our website (<https://clas.ucdenver.edu/mathematical-and-statistical-sciences/undergraduate-certificate-data-science-essentials/>).