DATA SCIENCE, BS

Introduction

Please click here (http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/business-school/) to see Business School information.

Please click here (http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/) to see College of Liberal Arts and Sciences information.

Please click here (http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-engineering-design-computing/) to see College of Engineering, Design and Computing information.

The explosive growth in data collection over the past 10 years is unlikely to slow any time soon. This has created a dramatic increase in demand for individuals who can understand how to make decisions and predictions in the context of uncertainty through use of experimental design, statistical methods, and programming, especially in the context of large data sets. This need spans many fields such as environmental applications of climate modeling over space and time, medical and genomic applications that use electronic medical records to correlate demographics, genetic data, and clinical outcomes over millions of individuals, national security applications (including real-time monitoring of internet trends), and manufacturing with real-time monitoring of features over a variety of processes to both troubleshoot and optimize manufacturing. Graduates of the BS in Data Science will be well-positioned to meet this need.

Program Delivery

- This is an on-campus program.

Declaring This Major

- Click here (http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/#policiestext) to go to information about declaring a major.

These degree 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 major advisor and CLAS advisor to confirm the best plans of study before finalizing them.

General Requirements

To earn a degree, students must satisfy all requirements in each of the three areas below, in addition to their individual major requirements.

- CU Denver Graduation Requirements (http://catalog.ucdenver.edu/cu-denver/undergraduate/graduation/)
- CU Denver Undergraduate Core Curriculum (http://catalog.ucdenver.edu/cu-denver/undergraduate/graduation-undergraduate-core-requirements/)
- Click here (http://catalog.ucdenver.edu/cu-denver/undergraduate/academic-policies-procedures/) for information about Academic Policies

Program Requirements

1. Students must complete a total of 87 major credit hours, from approved courses.
2. Students must complete at least 30 upper-division (3000-level and above) credit hours in the major.
3. Students must earn a minimum grade of C- (1.7) in all courses that apply to the major and must achieve a minimum cumulative major GPA of 2.25. Courses taken using P+/P/F or S/U grading cannot apply to major requirements.
4. Students must complete a minimum of 15 upper-division level credit hours with CU Denver faculty.

Code	Title	Hours
Complete the following BUSN courses: [1]		*15*
BMIN 1000	Introduction to Business	
BMIN 2200	Career and Professional Development	
ISMG 3100	Data Governance and Ethics	
BANA 4110	Business Analytics Processes	
BANA 4120	Forecasting Techniques	
Complete the following CSCI courses: [1]		*27*
CSCI 2400	Data Structures and Program Design for Data Science	
CSCI 2800	Special Topics (Data Science Thinking)	
CSCI 3400	Databases for Data Science	
CSCI 3450	Algorithms for Data Science	
CSCI 4455	Data Mining	
CSCI 4580	Data Science	
CSCI 4930	Machine Learning	
CSCI 4931	Deep Learning	
CSCI 4951	Big Data Systems	
Complete the following MATH courses: [1]		*36*
MATH 1376	Programming for Data Science	
MATH 1401	Calculus I	
MATH 2411	Calculus II	
MATH 2421	Calculus III	
MATH 2700	Data Analysis with R and Other Tools	
MATH 2830	Introductory Statistics	
MATH 3191	Applied Linear Algebra	
MATH 3376	Data Wrangling & Visualization	
MATH 3382	Statistical Theory	
MATH 3810	Introduction to Probability	
MATH 4387	Applied Regression Analysis	
Complete nine credits of 4000-level application domain electives		*9*
Total Hours		**87**

[1] Courses are under development and may be subject to change. Students should meet with their advisor to check and confirm course registration.

The program's student learning goals that define what the students should know and be able to do by the time of graduation are to:

- *Math & Programming Skills:* Apply the math and programming skills necessary for the work of data science.
- *Data Cycle:* Explore technical and practical data science by applying the data cycle to transform data into knowledge.

- *Data Preparation:* Assess and improve the quality of data relative to analytical needs.
- *Data Management:* Address data challenges of volume, variety, and velocity to enable efficient and effective data analysis.
- *Data Analysis:* Apply techniques, methodologies, and technologies for various forms of data analysis such as data modeling and data mining.
- *Data Visualization:* Create visualizations of complex data and results for delivery to diverse audiences.
- *Data Storytelling:* Explain data and results in writing and verbally, equipping stakeholders to make data-informed decisions.
- *Data Ethics:* Assess ethical implications in data science, such as privacy and bias.
- *Application Domains:* Apply data science in a variety of domains, such as healthcare, social sciences, natural sciences, physical science, business, education, and public administration.
- *Interprofessional Collaboration & Teamwork:* Exhibit the qualities of an effective interprofessional collaborator as part of a data science team and within organizations with diverse roles.

Graduates will be able to demonstrate these capabilities in a broad range of data science activities. The degree will prepare students for careers as data analysts, data scientists, data strategist and many other diverse careers that rely on data, which is essentially every corner of the job market today.

The following plans of study are examples of pathways that students can follow, depending on their entry level MATH placement.

To review a list of courses will fulfill CU Denver Core Arts, Behavioral Science, Humanities and Natural and Physical Sciences with and without a lab, please check the CU Denver Core Curriculum. (http://catalog.ucdenver.edu/cu-denver/undergraduate/graduation-undergraduate-core-requirements/#cudenvercorecurriculumtext)

Calculus I

Course	Title	Hours
Year 1		
Fall		
BMIN 1000	Introduction to Business	3
ENGL 1020	Core Composition I	3
MATH 1376	Programming for Data Science	3
MATH 1401	Calculus I	4
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
	Hours	**16**
Spring		
ENGL 2030	Core Composition II	3
CSCI 2800	Special Topics (Data Science Thinking)	3
MATH 2830	Introductory Statistics	3
MATH 2411	Calculus II	4
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
	Hours	**16**
Year 2		
Fall		
BMIN 2200 Career and Professional Development		3
CSCI 2400 Data Structures and Program Design for Data Science		3
ISMG 3100 Data Governance and Ethics		3
MATH 2421	Calculus III	4
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
	Hours	**16**
Spring		
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
CU Denver Core Natural and Physical Sciences with a lab (p. 2)		4-5
CSCI 3400 Databases for Data Science		3
MATH 2700 Data Analysis with R		3
MATH 3376	Data Wrangling & Visualization	3
	Hours	**16-17**
Year 3		
Fall		
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
MATH 3810	Introduction to Probability	3
CSCI 3450 Algorithms for Data Science		3
MATH 3191	Applied Linear Algebra	3
Open elective-student choice		3
	Hours	**15**
Spring		
Application Domain Elective		3
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
BANA 4110 Business Analytics Processes		3
CSCI 4580	Data Science	3
MATH 3382	Statistical Theory	3
	Hours	**15**
Year 4		
Fall		
Application Domain Elective		3
BANA 4120 Forecasting Techniques		3
CSCI 4455	Data Mining	3
CSCI 4931	Deep Learning	3
Open elective-student choice		3
	Hours	**15**
Spring		
Application Domain Elective		3
CSCI 4930	Machine Learning	3
CSCI 4951	Big Data Systems	3
MATH 4387	Applied Regression Analysis	3
	Hours	**12**
	Total Hours	**121-122**

Precalculus

Course	Title	Hours
Year 1		
Fall		
BMIN 1000	Introduction to Business	3
ENGL 1020	Core Composition I	3
MATH 1376	Programming for Data Science	3
MATH 1130	Precalculus Mathematics	4
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
	Hours	**16**
Spring		
ENGL 2030	Core Composition II	3
CSCI 2800	Special Topics (Data Science Thinking)	3
MATH 2830	Introductory Statistics	3
MATH 1401	Calculus I	4
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
	Hours	**16**
Year 2		
Fall		
BMIN 2200 Career and Professional Development		3
CSCI 2400 Data Structures and Program Design for Data Science		3
ISMG 3100 Data Governance and Ethics		3
MATH 2411	Calculus II	4
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
	Hours	**16**
Spring		
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
CSCI 3400 Databases for Data Science		3
MATH 2700 Data Analysis with R		3
MATH 2421	Calculus III	4
MATH 3376	Data Wrangling & Visualization	3
	Hours	**16**
Year 3		
Fall		
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
MATH 3810	Introduction to Probability	3
CSCI 3450 Algorithms for Data Science		3
MATH 3191	Applied Linear Algebra	3
CU Denver Core Natural and Physical Sciences with a lab (p. 2)		4-5
	Hours	**16-17**
Spring		
Application Domain Elective		3
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
BANA 4110 Business Analytics Processes		3
CSCI 4580	Data Science	3
MATH 3382	Statistical Theory	3
	Hours	**15**
Year 4		
Fall		
Application Domain Elective		3
BANA 4120 Forecasting Techniques		3
CSCI 4455	Data Mining	3
CSCI 4931	Deep Learning	3
Open elective-student choice		3
	Hours	**15**
Spring		
Application Domain Elective		3
CSCI 4930	Machine Learning	3
CSCI 4951	Big Data Systems	3
MATH 4387	Applied Regression Analysis	3
	Hours	**12**
	Total Hours	**122-123**

Algebra

Course	Title	Hours
Year 1		
Fall		
BMIN 1000	Introduction to Business	3
ENGL 1020	Core Composition I	3
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
MATH 1110	College Algebra	4
MATH 2830	Introductory Statistics	3
	Hours	**16**
Spring		
ENGL 2030	Core Composition II	3
CSCI 2800	Special Topics (Data Science Thinking)	3
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
MATH 1120	College Trigonometry	3
MATH 1376	Programming for Data Science	3
	Hours	**15**
Summer		
MATH 1401	Calculus I	4
	Hours	**4**
Year 2		
Fall		
BMIN 2200 Career and Professional Development		3
CSCI 2400 Data Structures and Program Design for Data Science		3
ISMG 3100 Data Governance and Ethics		3
MATH 2411	Calculus II	4
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
	Hours	**16**
Spring		
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3

CSCI 3400 Databases for Data Science		3
MATH 2700 Data Analysis with R		3
MATH 2421	Calculus III	4
MATH 3376	Data Wrangling & Visualization	3
	Hours	**16**
Year 3		
Fall		
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
MATH 3810	Introduction to Probability	3
CSCI 3450 Algorithms for Data Science		3
MATH 3191	Applied Linear Algebra	3
CU Denver Core Natural and Physical Sciences with a lab (p. 2)		4-5
	Hours	**16-17**
Spring		
Application Domain Elective		3
Core Arts, Humanities, Social Science, Behavioral Science, International Perspectives or Cultural Diversity (p. 2)		3
BANA 4110 Business Analytics Processes		3
CSCI 4580	Data Science	3
MATH 3382	Statistical Theory	3
	Hours	**15**
Year 4		
Fall		
Application Domain Elective		3
BANA 4120 Forecasting Techniques		3
CSCI 4455	Data Mining	3
CSCI 4931	Deep Learning	3
	Hours	**12**
Spring		
Application Domain Elective		3
CSCI 4930	Machine Learning	3
CSCI 4951	Big Data Systems	3
MATH 4387	Applied Regression Analysis	3
	Hours	**12**
	Total Hours	**122-123**