New Program Proposal Form

Name of Institution: University of South Carolina Columbia

Name of Program *(include degree designation and all concentrations, options, or tracks)*:
Bachelor of Science in Data Science

Program Designation:

- ☐ Associate's Degree
- ☒ Bachelor's Degree: 4 Year
- ☐ Bachelor's Degree: 5 Year
- ☐ Master's Degree
- ☐ Specialist
- ☐ Doctoral Degree: Research/Scholarship (e.g., Ph.D. and DMA)
- ☐ Doctoral Degree: Professional Practice (e.g., Ed.D., D.N.P., J.D., Pharm.D., and M.D.)

Consider the program for supplemental Palmetto Fellows and LIFE Scholarship awards?

- ☒ Yes
- ☐ No

Proposed Date of Implementation: Fall 2024

CIP Code, Title and Definition: 30.7001 Data Science, General

A program that focuses on the analysis of large-scale data sources from the interdisciplinary perspectives of applied statistics, computer science, data storage, data representation, data modeling, mathematics, and statistics. Includes instruction in computer algorithms, computer programming, data management, data mining, information policy, information retrieval, mathematical modeling, quantitative analysis, statistics, trend spotting, and visual analytics.

Delivery Site(s): 51102 – USC Columbia Main Campus

Delivery Mode:

- ☒ Traditional/face-to-face
  *select if less than 25% online
- ☐ Distance Education
- ☐ 100% online
- ☐ Blended/hybrid (50% or more online)
- ☐ Blended/hybrid (25-49% online)
- ☐ Other distance education (explain if selected)

Program Contact Information (name, title, telephone number, and email address):
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Institutional Approvals and Dates of Approval (include department through Provost/Chief Academic Officer, President, and Board of Trustees approval):
Provost Pre-Authorization: 4/27/2023
Department of Statistics: 4/20/2023
Department of Computer Science and Engineering: 4/20/2023
Department of Mathematics: 5/1/2023

College of Arts and Sciences: 4/28/2023
Faculty Senate Committee on Curricula and Courses: 5/18/2023
Faculty Senate: 6/7/2023
Board of Trustees Academic Excellence and Student Experience Committee: 8/19/2023 (expected)
Board of Trustees: 8/19/2023 (expected)

Statement of REACH Act Compliance (*undergraduate programs only*):
As per all bachelor's degree programs at the University of South Carolina, Columbia, the bulletin description for the Data Science, B.S. includes the following:

Founding Documents Requirement
All undergraduate students must take a 3-credit course or its equivalent with a passing grade in the subject areas of History, Political Science, or African American Studies that covers the founding documents including the United State Constitution, the Declaration of Independence, the Emancipation Proclamation and one or more documents that are foundational to the African American Freedom struggle, and a minimum of five essays from the Federalist papers. This course may count as a requirement in any part of the program of study including the Carolina Core, the major, minor or cognate, or as a general elective. Courses that meet this requirement are listed here.

Contents

Background

Description, Purpose, and Rationale

Provide a narrative describing the proposed program, explaining the purpose, intended audience, and for why the new academic program is necessary, and state the modalities of instruction.

Background and Purpose

Data Scientist careers are projected to be the sixth fastest growing occupation from 2021-2031 with 36% growth and a median salary of over $100,000 per year (BLS). As Data Science emerged as an interdisciplinary field over the past decade, universities took a variety of approaches to address the current and future demand, including minors, concentrations within existing degrees, and adding the name to existing departments and degrees. The dominant approach has become the dedicated Bachelor of Science in Data Science, with over 35 universities founding such degree programs in the past few years, including Arkansas, Florida, Georgia, and Mississippi State in the Southeast.

The proposed Bachelor of Science in Data Science at the University of South Carolina is the product of ongoing collaboration between the Departments of Mathematics and Statistics in the College of Arts and Sciences and the Department of Computer Science and Engineering in the College of Engineering and Computing. Its development has been supported in part by a five-year Research Training Group grant from the National Science Foundation. The proposed program builds on the existing faculty research and teaching strengths in Data Science, Machine Learning, and Artificial Intelligence across those departments and their past experience with the jointly run Minor in Data Science.

The proposed program is designed to provide its graduates with the computational, mathematical, and statistical background and expertise needed to immediately pursue a career in the field or graduate work, and to have the foundation that enables them to keep to evolve with new developments in the field. It does this while also having the intentional flexibility to allow its students to lean into the particular facet of Data Science (Computer Science, Mathematics, or Statistics, or area of application) that they choose.

Program

The degree requirements are based on the recommendations of the *Curriculum Guidelines for Undergraduate Programs in Data Science* and considers the experiences of the current B.S. in Statistics, B.S. in Mathematics, and Data Science Minor. The major begins with foundational coursework in mathematics, statistical methods, and computer science. Students then take courses in data visualization, data mining and statistical learning, statistical computing, advanced theory, technical writing, and ethics. The 120 hour major further contains elective and cognate (or minor) courses that target the student's individual career and educational goals. As with all degree programs in the College of Arts and Sciences, the Data Science degree also includes the foundational general education courses from the Carolina Core and their complementary college requirements.

Need

While this program is expected to be attractive to some students currently in the Departments of Mathematics, Statistics, and Computer Science and Engineering at USC, it is predominantly expected to attract students particularly interested in the intersection of these three fields. Launching the program now will keep us in the main cohort of research and state-flagship institutions in terms of offering highly sought after majors.
Peer/peer-aspirant Florida and Iowa State launched programs in 2020 and Fall 2018 respectively. In that time, their Data Science bachelors' programs have grown to about 100 and 150 students, respectively. This has not caused a decrease in the closely related Statistics degree program. The number of statistics majors (combined BA/BS) Florida

has increased from approximately 190 to 220 since 2020. The number of statistics majors in Iowa State has remained steady at approximately 100 majors.

Modalities of instruction
The program will be administered through in-person classes on the USC Columbia campus.

Alignment with Public Agenda
Provide a detailed explanation of how the proposed new academic program will advance the South Carolina Public Agenda for Higher Education.

The proposed Bachelor of Science in Data Science helps meet the big goals of Increasing Educational Attainment by:

- **Ensuring postsecondary education course offerings are aligned with workforce needs and requirements.** – Data Science is an area of rapidly increasing demand, and the program is designed around the suggested state of the art curriculum guidelines to produce flexible and well-qualified graduates.
- **Encouraging "on-time completion"** and **Developing and implementing clear, well-defined degree maps and degree pathways**. - The program is designed to start the students in the classes in the major immediately and to give the flexibility to choose from a variety of options to customize the program. This will avoid bottlenecks in course offerings and allow students to work to their own interests and strengths.
- **Ensuring earned academic credits transfer –** The included transfer plan for the A.S. with Concentration in Accelerated Mathematics from Midlands Technical gives credit for 63 of the 64 hours (all except the Midlands required COL-101 College Orientation) and allow for four-year graduation without taking any summer courses.

Alignment with Institutional Mission
Connect the proposed new academic program with the approved institutional mission.

The University of South Carolina is the State's flagship university and a Carnegie R1 institution. The primary mission of the University of South Carolina Columbia "is the education of the state's citizens through teaching, research, creative activity, and community engagement." The field of Data Science has been rapidly growing in terms of national employment demand and that trend is projected to continue. The rise of undergraduate programs in Data Science in comprehensive universities has reflected this over the past decade. Offering a dedicated pathway for students to become Data Scientists has become a vital requirement for fulfilling the mission of the University of South Carolina in educating the state's citizens and to serve its needs.

Duplication

Table 1 – Duplication

Similar or Related Degrees/Programs	CIP Code	5-Year Annual Average Supply of Graduates (Graduates/Completers)	Competitor Institutions at Public and Private Institutions in SC
B.S. in Data Science	30.7001	NA[1]	Clemson University
B.S. in Data Science	30.7001	8.42[2]	College of Charleston
B.S. in Data Science, with emphases in Business Analytics, Computer Information Systems, *and* Mathematics	30.7001	NA[1]	Lander University
B.A. in Data Science	30.7001	NA[1]	Winthrop University

1 – The program at Clemson is approved to begin Fall 2024. The Data Science programs at Lander University began in Fall 2021 and the program at Winthrop University began in Fall 2020.
2– From https://irp.cofc.edu/facts-and-publications/fact-book-index/index.php

Utilizing Table 1, explain how the proposed new academic program will differ (e.g., curricular scope, modality, market share, research and development, etc.) from existing programs at South Carolina public and private institutions and why the program is needed. Data should be provided from sources identified by CHE or from comparable sources of program outcomes data (e.g., EDEPS, IPEDS, etc.)

A program in Data Science (complementing those in Computer Science, Mathematics, and Statistics) is fast becoming an expected degree offering at research universities. This degree, in particular, has been requested by current and potential USC students. USC's proposed program differs from the offerings at other South Carolina institutions in that it includes higher level mathematics and statistics (similar to Clemson, and in contrast to the programs at College of Charleston, Lander, and Winthrop) and has the flexibility for focusing on various combinations of computing, mathematics, statistics, and areas of application (in contrast to the programs at Clemson, College of Charleston, and Lander).

<u>In Detail</u>
Clemson University has a newly proposed BS in Data Science. Its program is at a similar mathematical and statistical level to USC's program. The largest difference is in Clemson's requiring four additional courses in programming and database management. USC's program instead allows a student to construct a more tailored program in that vein by taking a cognate or minor in Computer Science. USC's program would also allow the student to use the cognate or minor to obtain additional courses in Mathematics, Statistics, or an area of application that would be beneficial for students applying for graduate degrees. Having slightly fewer other specified required courses also facilitates students who seek a double major using USC's program (an increasingly popular choice among our students).

College of Charleston (CofC) has a BS in Data Science. Its program has lower mathematical and statistical requirements (USC requires Calculus II; the CofC course in Discrete Structures does not transfer high enough for

USC's MATH 374; CofC's two-course statistical methods sequence transfers in as STAT 206 and 515 instead of STAT 515 and 516; CofC does not require a course in data visualization). On the other hand, CofC's program requires two additional courses in programming. CofC's program requires two specific courses in Statistical Learning, while USC's gives the choice of STAT 530 or STAT 587, and choice of MATH 511, 528, or 572. CofC's program also has several areas of emphasis that are similar to USC's cognates in a variety of fields – excluding Computer Science, Mathematics, or Statistics -and would assist students who wished to pursue graduate study in those fields.

Lander offers Data Science degrees with areas of emphasis in Business Analytics, Computer Information Systems, or Mathematics. The mathematics emphasis is the most similar to USC's program. Its introductory statistics course is at the STAT 201 level instead of the 515 level, the discrete mathematics course is at the MATH 174 instead of 374 level. The Lander program requires a course in Differential Equations that is relevant to a math focused student but not particularly to data science. The Lander program is also more specific in its requirements and is therefore not as flexible in allowing students to prepare for graduate work in specific disciplines, such as Computer Science, Mathematics, or Statistics.

Winthrop University has a BA in Data Science that requires a 15-24 hour minor. The linear algebra and statistics courses at Winthrop do not transfer in high enough for MATH 344 or STAT 515 respectively. The second required statistical methods course is of much narrower range. The Winthrop program has additional programming required but does not have the mathematics courses in discrete structures or calculus III, or have the advanced mathematics requirement.

Detail how the proposed program will contribute to new degree attainment. If there will be a significant redistribution of students from existing programs at the institution or institutions offering similar programs, please provide justification for the need for a new program.

Based on the experiences of peer/peer-aspirant programs, the BS in Data Science is not expected to cause a decrease in enrollment in the most similar major (Statistics). Rather enrollment shifts will reflect student and industry demand and mimic natural enrollment cycles across majors. It is not expected that USCs offering of this program will draw significantly from the related programs at SC universities since it differs significantly in mathematical and statistical level from those at the College of Charleston, Lander, and Winthrop. As an expected core discipline at a research university, it also seems unlikely that there will be a major redistribution in students between the proposed program at USC and the newly proposed program at Clemson. It may give USC an advantage over other R1 schools in other states that do not yet have a program of their own, or that have a program with a different focus.

Labor Market Needs and Student Demand

Industry Needs and Student Demand

*Provide an assessment of the need for the program for the institution, the state, the region, and beyond, if applicable. Sources of information include: Data from program accreditor, student Interest surveys, market analysis research, Economic Development and Employer Planning System (EDEPS), IPEDS, O*Net, Projections Central, and SC Works.*

Table 2 – South Carolina Labor Market / Career Placement Outlook and Salaries

Occupation	SOC Code	Source	Current Employment Totals	10 year % Growth Projections	Average Salary (O-Net data)	Future Earnings Potential (O-Net data)
Data Scientist	15-2051	BLS[1]	159,630 (US) 1,180 (SC)	36% (US) 2021-2031	$99,370	Not Available
Operations Research Analyst	15-2031	BLS [1]	105,080 (US) 870 (SC)	23% (US) 2021-2031	$80,200	Not Available
Computer and Information Research Scientists	15-1221	BLS [1]	33,780 (US) 430 (SC)	21% (US) 2021-2031	$113,440	Not Available
Statistician	15-2041	BLS [1]	30,780(US) 270 (SC)	31% (US) 2021-2031	$98,920	Not Available

Note – SOC Codes should closely align with the CIP code.

1 - Current National Employment Totals (May 2022): https://www.bls.gov/oes/current/oes_nat.htm
Current South Carolina Employment Totals (May 2022): https://www.bls.gov/oes/current/oes_sc.htm
10 year % Growth Projections (2021-2031): https://www.bls.gov/ooh/a-z-index.htm

Utilizing Table 2, provide a narrative supporting the labor market need and employment projections for the proposed new academic program to provide supporting evidence of anticipated employment opportunities for graduates. The narrative should include citations for data and demonstrate labor market needs for the proposed program. Data and narrative should support local, state, and national industry trends.

Industry Needs

Data Scientist is projected to be the sixth fastest growing occupation in the nation this decade with 36% growth and a median salary near $100,000 per year (BLS). This continues the trend started in the previous decade during which Data Science job postings on indeed.com rose by 256%. (HBR). The closest related occupations are also projected to have high average growth, ranging from 21-31% (Table 2). Among technology companies, jobs requiring analysis skills such as data science now regularly surpass the demand for more traditional fields such as engineering (Deloitte). Finally, as an additional sign of this national need, Data Science was added to the list of STEM Optional Practical Training extension eligible CIP codes by the U.S. Department of Homeland Security in 2022 (DHS).

Student Demand

The demand for programs in Data Science at USC is most directly demonstrated by the number of students who choose to minor in Data Science. Begun in Fall 2017, the minor has averaged ~ 73 enrolled students per Spring/Fall semester over the past three years. It is also reflected in the number of students who select the closely related courses CSCE 567, CSCE/STAT 587, and STAT 530, which greatly exceeds the number of seats needed by those minors (most recent three year average annual enrollments of approximately 101, 121, and 50 respectively). In addition, the NSF sponsored summer research experience for undergraduates in data science at USC has attracted 18 students in 2022 and 16 students in 2023.

A 2023 survey of University of South Carolina Statistics undergraduates found 21% interested in majoring in Data

Science and an additional 18% interested in double majoring. Programs at peer and peer-aspirant universities indicate that the growth in these programs is not taking students from related fields such as Statistics. Peer/peer-aspirant Florida and Iowa State launched programs in 2020 and Fall 2018 respectively. In that time, their Data Science bachelors' programs have grown to about 100 and 150 students, respectively, but has not caused a decrease in the closely related Statistics degree program. The number of statistics majors (combined BA/BS) Florida has increased from approximately 190 to 220 since 2020 and the number of statistics majors in Iowa State has been maintained at ~ 100 students.

One respondent to our undergraduate survey noted "I believe the development of a data science major is necessary with the current trend of technology and statistical methods." And a dedicated BS in Data Science has rapidly become an expected part of academic offerings. A partial list of universities with a bachelor's degrees specifically in Data Science includes: Arkansas, Brigham Young, California-Davis, California-Irvine, Central Florida, Chicago, Colorado-Denver, DePaul, Florida, Georgia, Georgia State, George Washington, Illinois-Chicago, Indiana, Iowa, Iowa State, Loyola, Marquette, Michigan, Mississippi State, New Jersey Institute of Technology, Northern Kentucky, Penn State, Purdue, Rochester, Siena, Southern Methodist, Stanford, Temple, Texas-Dallas, Texas Christian, Tufts, Utah, Washington in St. Louis, West Virginia, William and Mary, and Wisconsin-Milwaukee. All these programs were founded recently, and others (such as Wisconsin-Madison) have programs seeking approval or waiting to start. Further, this list excludes programs with related names (such as Data Science and Analytics or Statistics and Data Science). Interviews with over a dozen USC students interested in Data Science found that a degree in Data Science would be preferable to a minor or concentration.

Industry Collaboration and Feedback

Provide evidence (e.g., industry advisory councils, formal/informal industry collaborations, internship/externship opportunities, letters of support, etc.) of institution-industry collaboration for the proposed new academic program. Letters of support from regional/statewide industry partners should be included in the appendix.

See attached letters of support.

Academic Planning

Enrollment and Graduation Projections

Using Table 3, provide a narrative detailing the anticipated enrollment, attrition, and graduation projections. Explain how the enrollment projections were calculated. Enrollment should be realistic and based on demonstrated student demand as identified in a feasibility study or through benchmarking with existing similar programs. Data from a feasibility study or benchmarking for the proposed program should accompany the proposal in the appendix. Enrollment and graduation projections should meet CHE degree productivity standards based on the degree level expectations. Enrollment projections should consider data provided in Table 2 to ensure the program does not oversaturate future labor market needs.

Table 3 – Enrollment Projections

Year	Fall New Enrollment	Spring New Enrollment	Summer New Enrollment	Total New Annual Enrollment	Projected Attrition	Projected Graduates
1	10	0	0	10	0	0
2	20	0	0	20	0	0
3	25	0	0	25	0	0
4	25	0	0	25	1	9
5	25	0	0	25	3	17

The enrollment projections assume that 10 new students join the program in the first year, with enrollment doubling in the second year after the program has had time to gain more attention. Following year two, enrollment is expected to grow slightly and then remain steady at approximately 25 new students each year. These numbers are estimated based on data from similar programs at peer and peer-aspirant institutions, as well as numbers of students currently enrolled in the tangential fields of Mathematics, B.S.; Statistics, B.S.; and Computer Science, B.S..

Academic Standards

Clearly articulate the admission, retention, and graduation standards for the proposed program. Should the proposed program differ from standard institutional admission, retention, and graduation standards, please provide a brief explanation regarding the need for such differences.

The admission standards are the same as regular institutional admission standards for majors in the College of Arts and Sciences at the University of South Carolina. The transfer, retention, and graduation requirements are based on those of the B.S. in Statistics and B.S. in Mathematics to ensure the students have a high likelihood of succeeding in the advanced courses (transfer and retention) and of having the necessary skills to succeed in a Data Science career (graduation).

Retention

To be retained in the program, a student must obtain a grade of C or higher in at most two attempts in all mathematics, computer science, and statistics courses required for graduation.

Transfer Requirement

Any student applying to transfer to the Data Science major from other programs within the University, or from other accredited colleges and universities, is required to have earned a grade of "B" or higher in at least one of the following courses, or their equivalent: USC's MATH 141, MATH 142, MATH 241, STAT 509, or STAT 515. An AP or IB exam score that provides credit for MATH 142 also satisfies this requirement. STAT 509 and STAT 515 are advanced undergraduate courses. This requirement is in addition to the minimum University and College of Arts and Sciences requirements.

Graduation

In addition to all mathematics, computer science, and statistics courses required for graduation (see the retention requirements) and ENGL 101 and 102 (a USC requirement), a grade of C or higher must also be earned in the course satisfying the Ethics in Data Science requirement and the course in business or technical writing.

Marketing and Recruitment

Provide a plan outlining how the institution will market and recruit targeted populations (e.g., transfer, adult learners, underrepresented populations, etc.).

College of Arts and Sciences recruitment staff will work with the Data Science program committee to coordinate promotion by university recruitment representatives nationally, and at Admissions events, including Open House, Admitted Students and Top Scholars weekends, and Family Weekends. The program will be featured in college recruitment brochures and social media. The Data Science program committee will coordinate with the Visitors Center to host major information sessions during each spring semester. College recruitment staff will coordinate promotion of the degree to summer programs targeting underrepresented minority high school students at the Spring Showcase and Summer Seniors programs.

Program of Study

*Provide the proposed program of study for full-time students and differentiate between existing courses, newly developed and approved courses (put an * by new courses), core courses, and electives courses for the proposed program. Provide the course suffix, course number, course description, credit hours, and link to the course catalog for each existing course in the program of study.*

The full major map and transfer pathway map (paralleling the outlines below) are attached in the supplementary materials. Note that STAT 542 is a newly created optional course for the Statistics, B.S. and a required course for the proposed Data Science, B.S. and proposed Data Analytics, B.S..

Curriculum by Year					
Course Name	Credit Hour	Course Name	Credit Hours	Course Name	Credit Hours
Year 1					
Fall		Spring		Summer	
ENGL 101 Critical Reading and Comp	3	ENGL 102 Rhetoric and Comp	3		
MATH 141 Calculus I	4	MATH 142 Calculus II	4		
STAT 515 Statistical Methods I	3	STAT 516 Statistical Methods II	3		
Foreign language *or* Carolina Core	3-4	Foreign language *or* Carolina Core	3-4		
UNIV 101 or Carolina core	3	Carolina Core Requirement	3		
Total Semester Hours	16-17	Total Semester Hours	16-17	Total Sem. Hrs.	0

Year 2					
Fall		Spring		Summer	
MATH 241 Vector Calculus	3	MATH 344 Applied Linear Algebra *or* MATH 544 Linear Algebra	3		
STAT 530 Appl Multivariate Stat *or* CSCE/STAT 587 Big Data Analytics	3	MATH 344L Appl Linear Algebra Lab	1		
CSCE 206 Scientific Applications Prog.	3	CSCE 567 Visualization Tools	3		
Foreign Language *or* Carolina Core	3-4	ITEC 101 Thriving in the Tech Age *or* PHIL 325 Engineering Ethics	3		

Carolina Core Requirement	3-4	Cognate or Minor Course	3		
		History	3		
Total Semester Hours	15-17	Total Semester Hours	16-17	Total Sem. Hrs.	0

Year 3					
Fall		Spring		Summer	
MATH 374 Discrete Structures *or* MATH 574 Discrete Mathematics	3	MATH/STAT 511 Probability *or* MATH 528 Mathematical Foundations of Data Science and Machine Learning *or* MATH 572 Mathematical Foundations of Network Science	3		
*STAT 542 Computing for Data Science	3	ENGL 363 Intro. to Technical Writing *or* ENGL 462 Technical Writing *or* ENGL 463 Business Writing	3		
Cognate or Minor Course	3	Cognate or Minor Course	3		
Carolina Core Requirement or Approve Elective	3-4	Carolina Core Requirement *or* Approved Elective	3-4		
Social Science	3	Carolina Core Requirement *or* Approved Elective	3-4		
Total Semester Hours	15-16	Total Semester Hours	15-17	Total Sem. Hrs.	0

Year 4					
Fall		Spring		Summer	
Data Science Major Elective	3	Data Science Major Elective	3		
Cognate or Minor Course	3	Minor Course or Approved Elective	3		
Minor Course or Approved Elective	3	Approved Elective	3		
Carolina Core Requirement *or* Approved Elective	3-4	Approved Elective	3		
Carolina Core Requirement *or* Approved Elective	3-4				
Total Semester Hours	15-17	Total Semester Hours	12	Total Sem. Hrs.	0

If a baccalaureate program, provide a program of study for students matriculating from a South Carolina Technical College System institution in the most common related program(s) of study to the proposed program.

Transfer information for students interested in pursuing a bachelor's degree is available at https://sc.edu/about/offices_and_divisions/undergraduate_admissions/requirements/for_transfers/ with specific information targeted to the students enrolled in a South Carolina technical College institution available at https://sc.edu/about/offices_and_divisions/undergraduate_admissions/requirements/for_transfers/credits_from_s

c_technical_colleges/. We are also engaged in discussions with Midlands Technical College, Greenville Technical College and Trident Technical college about direct transfer pathways and plan to develop pathways for this degree program. The following program of study is based on A.S. with Concentration in Accelerated Mathematics from Midlands Technical College (63 transfer hours) (see attachment for additional information).

A.S. with Concentration in Accelerated Mathematics from Midlands Technical College (63 transfer hours)

Course at Midlands Technical College	Credit Hours	Transfer Course at University of South Carolina	Code
ENG 101 English Composition I	3	ENGL 101 Critical Reading & Comp	CC-CMW
ENG 102 English Composition II	3	ENGL 102 Rhetoric and Composition	CC-CMW CC-INF
SPC 205 Public Speaking	3	SPCH 140 Public Communication	CC-CMS
MUS 105 Music Appreciation *or* ART 101 Art History and Appreciation *or* THE 101 Introduction to Theatre	3	MUSC 110 Introduction to Music or ARTE 101 Introduction to Art or THE 200 Understanding & Apprec Theatre	CC-AIU
ECO 210 Macroeconomics		ECO 222 Principles of Macroeconomics	CR
HIS 101 Western Civilization to 1689 or HIS 102 Western Civilization Post 1689	3	HIST 101 Eur Civ: Ancient – Mid 17th Cent *or* HIST 102 Eur Civ: From Mid 17th Cent	CC-GHS
HIS 201 American History: Discovery to 1877C	3	HIST 111 US History to 1865	CR
CHM 110 College Chemistry I or PHY 221 University Physics I	4	CHEM 111 General Chemistry I and 111L Lab *or* PHYS 211 Essentials of Physics I and 211L	CC-SCI
CHM 111 College Chemistry II *or* PHY 222 University Physics II	4	CHEM 112 General Chemistry II and 112L Lab *or* PHYS 212 Essentials of Physics I and 212L	CC-SCI
MAT 140 Analytical Geometry and Calculus I	4	MATH 141 Calculus I	CC-ARP
MAT 141 Analytical Geometry and Calculus II	4	MATH 142 Calculus II	CC-ARP
MAT 240 Analytical Geometry and Calculus III	4	MATH 241 Vector Calculus	CR
MAT 242 Differential Equations	4	MATH 242 Elem Differential Equations	PR
EGR 281 Introduction to Algorithmic Design I	4	CSCE 145 Algorithmic Design I	PR
EGR 209 Statistics for Engineers	3	STAT 509 Statistics for Engineers	PR
MAT 120 Probability and Statistics	3	STAT 201 Elementary Statistics	PR
SPA 101 Elementary Spanish I or FRE 101 Elementary French I	4	SPAN 109 Beginning Spanish I or FREN 109 Beginning French I	CC-GFL
SPA 102 Elementary Spanish II or FRE 102 Elementary French II	4	SPAN 110 Beginning Spanish II or FREN 110 Beginning French II	CC-GFL

Year 3 at USC					
Fall		Spring		Summer	
MATH 344 Applied Linear Algebra	3	MATH 374 Discrete Structures	3		
MATH 344L Applied Linear Algebra Lab	1	STAT 516 Statistical Methods II	3		
STAT 530 Applied Multivariate Statistics and Data Mining *or* CSCE/STAT 587 Big Data Analytics	3	CSCE 567 Visualization Tools	3		
CSCE 206 Scientific Applications Programming	3	ITEC 101 – Thriving in the Tech Age *or* PHIL 325 – Engineering Ethics	3		
SPAN 122 Basic Proficiency in Spanish *or* FREN 122 Basic Proficiency in French	3	Cognate *or* Minor Course	3		
Carolina Core Requirement[5]	3				
Total Semester Hours	16	Total Semester Hours	15	Total Sem.Hrs.	0
Year 4					
Fall		Spring		Summer	
MATH/STAT 511 Probability *or* MATH 528 Mathematical Foundations of Data Science and Machine Learning *or* MATH 572 Mathematical Foundations of Network Science	3	Data Science Major Elective	3		
STAT 542 Computing for Data Science	3	Cognate, Minor, or Approved Elective[7,8]	3		
ENGL 363 Introduction to Professional Writing *or* ENGL 462 Technical Writing *or* ENGL 463 Business Writing	3	Cognate, Minor, or Approved Elective[7,8]	3		
Data Science Major Elective	3	Cognate, Minor, or Approved Elective[7,8]	3		
Cognate *or* Minor Course[7]	3				
Total Semester Hours	15	Total Semester Hours	12	Total Sem.Hrs.	0

Courses with Descriptions and Hyperlinks to Academic Bulletin

Note: Changes to the prerequisites of CSCE 569, 582, 587, MATH 374, 529, 572, STAT 530, 540, 582, and 587 are being implemented to account for other course changes, the creation of two courses for the Data Analytics BS, and the facilitation of the Data Analytics BS and Data Science BS.

Required Courses: These Courses are either specifically required or are one of a small number of options as indicated in the program of study above.

CSCE 206 - Scientific Applications Programming (3 Credits)
Introduction to computer applications in science and engineering. Programming exercises in a high-level language.
Prerequisites: **MATH 122** or **MATH 141**.
https://academicbulletins.sc.edu/search/?search=csce+206

CSCE 567 - Visualization Tools (3 Credits)
Scientific visualization tools as applied to sampled and generated data; methods for data manipulation and representation; investigation of visualization techniques.
Prerequisites: **CSCE 145** or **CSCE 206** or **CSCE 207**.
https://academicbulletins.sc.edu/search/?search=csce+567

CSCE 587 - Big Data Analytics (3 Credits)
Foundational techniques and tools required for data science and big data analytics. Concepts, principles, and techniques applicable to any technology and industry for establishing a baseline that can be enhanced by future study.
Prerequisites: **STAT 509**, **STAT 513**, or **STAT 515**.
Cross-listed course: **STAT 587**
https://academicbulletins.sc.edu/search/?search=csce+587

ENGL 101 - Critical Reading and Composition (3 Credits)
Instruction in strategies for critically reading and analyzing literature and non-literary texts; structured, sustained practice in composing expository and analytical essays.
Carolina Core: CMW
https://academicbulletins.sc.edu/search/?search=engl+101

ENGL 102 - Rhetoric and Composition (3 Credits)
Instruction and intensive practice in researching, analyzing, and composing written arguments about academic and public issues.
Prerequisites: C or better in **ENGL 101** or equivalent credit.
Carolina Core: CMW, INF
https://academicbulletins.sc.edu/search/?search=engl+102

ENGL 363 - Introduction to Professional Writing (3 Credits)
Overview of concepts, contexts, and genres used in professional communication. Intensive practice in analyzing, emulating, and creating textual and multimedia documents for a variety of professional, non-academic purposes (including commercial, informative, persuasive, and technical).
Prerequisite or Corequisite: C or higher in both **ENGL 101** and **ENGL 102**.
https://academicbulletins.sc.edu/search/?search=engl+363

ENGL 462 - Technical Writing (3 Credits)
Preparation for and practice in types of writing important to scientists, engineers, and computer scientists, from brief technical letters to formal articles and reports.
Prerequisites: **ENGL 101** and **ENGL 102**.
Graduation with Leadership Distinction: GLD: Professional and Civic Engagement Leadership Experiences
https://academicbulletins.sc.edu/search/?search=ENGL+462

ENGL 463 - Business Writing (3 Credits)
Extensive practice in different types of business writing, from brief letters to formal articles and reports.
Prerequisites: **ENGL 101** and **ENGL 102**.
Graduation with Leadership Distinction: GLD: Professional and Civic Engagement Leadership Experiences, GLD: Research
https://academicbulletins.sc.edu/search/?search=engl+463

ITEC 101 - Thriving in the Tech Age (3 Credits)
Pervasive impact of computers on today's global society; skills and strategies for using technology. How information technologies impact daily life and drive change.
Carolina Core: VSR
https://academicbulletins.sc.edu/search/?search=itec+101

MATH 141 - Calculus I (4 Credits)
Functions, limits, derivatives, introduction to integrals, the Fundamental Theorem of Calculus, applications of derivatives and integrals. Four classroom hours and one laboratory hour per week.
Prerequisites: C or better in **MATH 112**, **MATH 115**, or **MATH 116**, or placement through Precalculus version of the Mathematics Placement Test.
Carolina Core: ARP
https://academicbulletins.sc.edu/search/?search=math+141

MATH 142 - Calculus II (4 Credits)
Methods of integration, sequences and series, approximations. Four classroom hours and one laboratory hour per week.
Prerequisites: C or better in **MATH 141**.
Carolina Core: ARP
https://academicbulletins.sc.edu/search/?search=math+142

MATH 241 - Vector Calculus (3 Credits)
Vector algebra, geometry of three-dimensional space; lines, planes, and curves in space; polar, cylindrical, and spherical coordinate systems; partial differentiation, max-min theory; multiple and iterated integration, line integrals, and Green's theorem in the plane.
Prerequisites: C or better in **MATH 142**.
https://academicbulletins.sc.edu/search/?search=math+241

MATH 344 - Applied Linear Algebra (3 Credits)
General solutions of systems of linear equations, vector spaces and subspaces, linear transformations, determinants, orthogonality, characteristic polynomials, eigenvalues and eigenvectors, singular value decomposition, and generalized inverse. **MATH 344L** is an optional laboratory course where additional applications will be discussed.

Prerequisites: C or better in **MATH 142**.
https://academicbulletins.sc.edu/search/?search=math+344

MATH 344L - Applied Linear Algebra Lab (1 Credit)
Computer based applications of linear algebra for science and engineering students. Topics include numerical analysis of matrices, direct and indirect methods for solving linear systems, and least squares method (regression). Typical applications include practical issues related to discrete Markov processes, image compression, and linear programming.
Prerequisite or Corequisite: C or better or concurrent enrollment in **MATH 344** or **MATH 544**.
https://academicbulletins.sc.edu/search/?search=math+344l

MATH 374 - Discrete Structures (3 Credits)
Propositional and predicate logic; proof techniques; recursion and recurrence relations; sets, combinatorics, and probability; functions, relations, and matrices; algebraic structures.
Prerequisites: C or better in both **MATH 142** and **CSCE 146**.
https://academicbulletins.sc.edu/search/?search=math+374

MATH 511 - Probability (3 Credits)
Probability and independence; discrete and continuous random variables; joint, marginal, and conditional densities, moment generating functions; laws of large numbers; binomial, Poisson, gamma, univariate, and bivariate normal distributions.
Prerequisite or Corequisite: C or better in **MATH 241**.
Cross-listed course: STAT 511
https://academicbulletins.sc.edu/search/?search=math+511

MATH 528 - Mathematical Foundation of Data Science and Machine Learning (3 Credits)
Unconstrained and constrained optimization, gradient descent methods for numerical optimization, supervised and unsupervised learning, various reduced order methods, sampling and inference, Monte Carlo methods, deep neural networks.
Prerequisites: C or better in **MATH 344** or **MATH 544**.
https://academicbulletins.sc.edu/search/?search=math+528

MATH 544 - Linear Algebra (3 Credits)
Vectors, vector spaces, and subspaces; geometry of finite dimensional Euclidean space; linear transformations; eigenvalues and eigenvectors; diagonalization. Throughout there will be an emphasis on theoretical concepts, logic, and methods. MATH 544L is an optional laboratory course where additional applications will be discussed.
Prerequisites: C or better in **MATH 241** and **MATH 300**.
https://academicbulletins.sc.edu/search/?search=math+544

MATH 572 - Mathematical Foundation of Network Science (3 Credits)
Graphs and probability, Web graphs, random graphs, models for complex graphs, graph searching algorithms, eigenvalues, PageRank.
Prerequisites: C or better in **MATH 374** and in one of **MATH 344** or **MATH 544**.
https://academicbulletins.sc.edu/search/?search=math+572

MATH 574 - Discrete Mathematics I (3 Credits)

Mathematical models; mathematical reasoning; enumeration; induction and recursion; tree structures; networks and graphs; analysis of algorithms.
Prerequisites: C or better in **MATH 300**.
https://academicbulletins.sc.edu/search/?search=math+574

PHIL 325 - Engineering Ethics (3 Credits)
An investigation of ethical issues in engineering and engineering-related technology. Topics include whistleblowing, employee/employer relations, environmental issues, issues related to advances in information technology, and privacy.
Carolina Core: CMS, VSR
Graduation with Leadership Distinction: GLD: Community Service, GLD: Professional and Civic Engagement Leadership Experiences
https://academicbulletins.sc.edu/search/?search=phil+325

STAT 511 - Probability (3 Credits)
Probability and independence; discrete and continuous random variables; joint, marginal, and conditional densities; moment generating functions; laws of large numbers; binomial, Poisson, gamma, univariate and bivariate normal distributions.
Prerequisite or Corequisite: C or better in **MATH 241**.
Cross-listed course: MATH 511
https://academicbulletins.sc.edu/search/?search=stat+511

STAT 515 - Statistical Methods I (3 Credits)
Applications and principles of elementary probability, essential discrete and continuous probability distributions, sampling distributions, estimation, and hypothesis testing. Inference for means, variances, proportions, one-way ANOVA, simple linear regression, and contingency tables. Statistical packages such as SAS or R. May not be taken concurrently with or after **STAT 509**, **STAT 513**, or **STAT 516**. Not for CAS, MAS, MS, or PhD credit in Statistics.
Prerequisites: C or higher in **MATH 122** or **MATH 141**; or both **MATH 111** or higher and any statistics class.
https://academicbulletins.sc.edu/search/?search=stat+515

STAT 516 - Statistical Methods II (3 Credits)
Applications and principles of linear models. Simple and multiple linear regression, analysis of variance for basic designs, multiple comparisons, random effects, and analysis of covariance. Statistical packages such as SAS. Not for CAS, MAS, MS, or PhD credit in Statistics.
Prerequisites: C or higher in **STAT 515**, **STAT 509**, **STAT 512**, or equivalent.
https://academicbulletins.sc.edu/search/?search=stat+516

STAT 530 - Applied Multivariate Statistics and Data Mining (3 Credits)
Introduction to fundamentals of multivariate statistics and data mining. Principal components and factor analysis; multidimensional scaling and cluster analysis; MANOVA and discriminant analysis; decision trees; and support vector machines. Use of appropriate software.
Prerequisites: C or higher in **STAT 515**, **STAT 205**, **STAT 509**, **STAT 512**, **ECON 436**, **MGSC 391**, **PSYC 228**, or equivalent.
https://academicbulletins.sc.edu/search/?search=stat+530

***STAT 542 - Computing for Data Science (3 Credits)**

Techniques for data visualization and graphics including interactive graphics, data wrangling and cleaning, data ethics, database querying and administration.
Prerequisites: C or better in **STAT 301**, **STAT 509**, **STAT 515** or equivalent, or permission of department.
https://academicbulletins.sc.edu/search/?search=stat+542
This course was approved by USC Faculty Senate on June 7, 2023.

STAT 587 - Big Data Analytics (3 Credits)
Foundational techniques and tools required for data science and big data analytics. Concepts, principles, and techniques applicable to any technology or industry for establishing a baseline that can be enhanced by future study.
Prerequisites: **STAT 509**, **STAT 513**, or **STAT 515**.
Cross-listed course: **CSCE 587**
https://academicbulletins.sc.edu/search/?search=stat+587

STAT 582 - Bayesian Networks and Decision Graphs (3 Credits)
Normative approaches to uncertainty in artificial intelligence. Probabilistic and causal modeling with Bayesian networks and influence diagrams. Applications in decision analysis and support. Algorithms for probability update in graphical models.
Prerequisites: **CSCE 350**, **STAT 509**, or **STAT 515**.
Cross-listed course: **CSCE 582**
https://academicbulletins.sc.edu/search/?search=stat+582

Electives: University 101 is a recommended elective course for first semester students.

UNIV 101 - The Student in the University (3 Credits)
The purposes of higher education and potential roles of the student within the university. Open to freshmen. Also open to other undergraduate students in their first semester of enrollment.
https://academicbulletins.sc.edu/search/?search=univ+101

Major Electives: These are the options for the four Major Electives in the Program of Study above. Any of STAT 530, CSCE/STAT 587, MATH/STAT 511, MATH 528, or MATH 572 that were not taken as required course options may be used as a major elective.

BIOL 588 - Genomic Data Science (3 Credits)
This course focuses on quantitative knowledge for interdisciplinary applications in genetics as well as hands-on experience in analyzing genetic data. In this course, students will have programming exercises in using analysis tools to conduct genome-wide analysis, annotation, and interpretation of genetic data using R/Bioconductor packages.
Prerequisites: C or better in **STAT 201** or higher.
Cross-listed course: STAT 588
https://academicbulletins.sc.edu/search/?search=biol+588

CSCE 556 - Data Analysis in Python: Application to Neuroscience (3 Credits)
Hands-on introduction in Python to the analysis of neuroscience data (human neuroimaging and cellular electrophysiology), including various aspects such as data wrangling, statistics, classification, and visualization.
Prerequisites: C or better in **CSCE 240** or **CSCE 206**.
https://academicbulletins.sc.edu/search/?search=csce+556

CSCE 569 - Parallel Computing (3 Credits)
Architecture and interconnection of parallel computers; parallel programming models and applications; issues in high-performance computing; programming of parallel computers.
Prerequisites: knowledge of programming in a high-level language; **MATH 526** or **MATH 544**.
https://academicbulletins.sc.edu/search/?search=csce+569

CSCE 580 - Artificial Intelligence (3 Credits)
Heuristic problem solving, theorem proving, and knowledge representation, including the use of appropriate programming languages and tools.
Prerequisites: CSCE 350.
https://academicbulletins.sc.edu/search/?search=csce+580

CSCE 582 - Bayesian Networks and Decision Graphs (3 Credits)
Normative approaches to uncertainty in artificial intelligence. Probabilistic and causal modeling with Bayesian networks and influence diagrams. Applications in decision analysis and support. Algorithms for probability update in graphical models.
Prerequisites: CSCE 350, **STAT 509**, or **STAT 515**.
Cross-listed course: STAT 582
https://academicbulletins.sc.edu/search/?search=csce+582

CSCE 585 - Machine Learning Systems (3 Credits)
Design and implementation of machine learning systems, Deep learning systems stack, machine learning platforms, scalable and distributed machine learning.
Prerequisites: C or better in **CSCE 240** or **CSCE 206**.
https://academicbulletins.sc.edu/search/?search=csce+585

MATH 524 - Nonlinear Optimization (3 Credits)
Descent methods, conjugate direction methods, and Quasi-Newton algorithms for unconstrained optimization; globally convergent hybrid algorithm; primal, penalty, and barrier methods for constrained optimization. Computer implementation of algorithms.
Prerequisites: C or better in **MATH 241** and one of **MATH 344** or **MATH 544**.
https://academicbulletins.sc.edu/search/?search=math+524

MATH 529 - Introduction to Deep Neural Networks (3 Credits)
Review of relevant concepts of linear algebra, Fourier transform and convolution, Fast Fourier Transform (FFT), mean and variance, covariance matrices and joint probabilities, gradient descent and stochastic gradient descent, structure of deep neural networks and convolutional neural networks, applications to image processing.
Prerequisites: C or better in **MATH 344** or **MATH 544**.
https://academicbulletins.sc.edu/search/?search=math+529

STAT 512 - Mathematical Statistics (3 Credits)
Functions of random variables, order statistics, sampling distributions, central limit theorem, quality of estimators, interval estimation, sufficient statistics, minimum-variance unbiased estimator, maximum likelihood, large-sample theory, introduction to hypothesis testing.
Prerequisites: C or better in **STAT 511** or **MATH 511**.
https://academicbulletins.sc.edu/search/?search=stat+512

STAT 517 - Advanced Statistical Models (3 Credits)
Theory and applications of advanced statistical models. Includes implementation and assessment of generalized linear, nonlinear and nonparametric regression, mixed effect, repeated measures, multivariate regression, and spatial models.
Prerequisites: **STAT 512** or **STAT 516** or equivalent.
https://academicbulletins.sc.edu/search/?search=stat+517

STAT 519 - Sampling (3 Credits)
Techniques of statistical sampling in finite populations with applications in the analysis of sample survey data. Topics include simple random sampling for means and proportions, stratified sampling, cluster sampling, ratio estimates, and two-stage sampling.
Prerequisites: C or higher in **STAT 515**, **STAT 509**, **STAT 512**, or equivalent.
https://academicbulletins.sc.edu/search/?search=stat+519

STAT 535 - Introduction to Bayesian Data Analysis (3 Credits)
Principles of Bayesian statistics, including: one- and multi-sample analyses; Bayesian linear models; Monte Carlo approaches; prior elicitation; hypothesis testing and model selection; hierarchical models; selected advanced models; statistical packages such as WinBUGS and R.
Prerequisites: C or better in **STAT 512**, **CSCE 582** or **STAT 582**; or both **STAT 511** and either **STAT 509** or **STAT 515**; or equivalent.
https://academicbulletins.sc.edu/search/?search=stat+535

STAT 540 - Computing in Statistics (3 Credits)
An introduction to statistical packages such as R and SAS with special focus on data management and computing procedures such as Monte Carlo simulation.
Prerequisites: C or higher in **STAT 515**, **STAT 509**, **STAT 512**, or equivalent.
https://academicbulletins.sc.edu/search/?search=stat+540

STAT 541 - Advanced SAS Programming (3 Credits)
Advanced programming techniques in SAS, including database management, macro language, and efficient programming practices.
Prerequisites: **STAT 540**.
https://academicbulletins.sc.edu/search/?search=stat+541

STAT 588 - Genomic Data Science (3 Credits)
This course focuses on quantitative knowledge for interdisciplinary applications in genetics as well as hands-on experience in analyzing genetic data. In this course, students will have programming exercises in using analysis tools to conduct genome-wide analysis, annotation, and interpretation of genetic data using R/Bioconductor packages.
Prerequisites: C or better in **STAT 201** or higher.
Cross-listed course: BIOL 588
https://academicbulletins.sc.edu/search/?search=stat+588

Assessment

Identify the appropriate person(s) or office responsible for conducting assessments and evaluations of the proposed program. Provide a crosswalk of student learning outcomes (SLO), the respective courses where the SLOs are intended to be fulfilled, and detail the evaluation methodology to ensure outcomes are achieved.

Student Learning Outcome Assessment

The Data Science Undergraduate Program Director will be the Data Science Assessment Plan Writer, the faculty member who will oversee the program assessment of this degree program. Based on the requirements of the Office of Institutional Research, Assessment and Analytics, the Undergraduate Director will conduct a program learning outcome assessment on a two-year cycle. Table 4 contains an alignment table indicating Goals, Objectives, Courses and Methods. Data will be collected from faculty teaching the indicated courses and analyzed based on the methodology outlined in the Assessment Plan. Part of this methodology will include collecting class assignment data at the end of the term and aggregating the results for basic descriptive analysis. The Undergraduate Director will compile the assessment results, write up an assessment report which will be shared with leadership and faculty who teach courses within the program to determine if the learning outcome is met and if any curriculum improvements will be needed.

Table 4 – Student Learning Outcomes and Assessment/Evaluation Methodology

Program Objectives (Goals)	Student Learning Outcomes Aligned to Program Objectives	Courses where SLOs are Intended to be Fulfilled	Methods of Assessment/Evaluation Methodology
Students are expected to learn the knowledge, skills, and comprehensive approaches to data science from both theoretical and application-based perspectives.	Analyze complex data using data science knowledge and concepts; appropriate models and methods; quantitative tools; and problem-solving skills to address research questions	STAT 530; or CSCE/STAT 587	95% of students should score at least a minimally acceptable score on this measure and 80% of students score at a proficient or higher level on the following assignment: Comparative exercise on multiple predictive statistical learning/discriminant methods.
	Manage complex data sets to be able to extract useful information	STAT 542	95% of students should score at least a minimally acceptable score on this measure and 80% of students score at a proficient or higher level on the following assignment: Messy data extraction, with clean-up and organization exercise
	Synthesize knowledge in the core areas of data science, including statistical, mathematical, and programming fundamentals	MATH 344L	95% of students should score at least a minimally acceptable score on this measure and 80% of students score at a proficient or higher level on the following

Program Objectives (Goals)	Student Learning Outcomes Aligned to Program Objectives	Courses where SLOs are Intended to be Fulfilled	Methods of Assessment/Evaluation Methodology
			assignment: Applied spectral decomposition programming exercise
Students are expected to understand what the implications are for the use of data and its impact on people and society.	Identify the ethical, policy, and security considerations and issues of working with data and how its use impacts society	STAT 542	95% of students should score at least a minimally acceptable score on this measure and 80% of students score at a proficient or higher level on the following assignment: Exam answer exploring ethical issues in data use
Students are expected to be able to present the results of their work with data in a variety of ways to their intended audiences in a clear and concise method.	Communicate data and reports effectively in either a data visualization, written or oral format appropriate to intended audience	STAT 516 or CSCE 567	95% of students should score at least a minimally acceptable score on this measure and 80% of students score at a proficient or higher level on the following assignment: Report on a data analysis; major statistical graphics display/visualization

Explain how the proposed program, including all program objectives, will be evaluated, along with plans to track employment. Describe how assessment data will be used.

Program Evaluation of Student Success

To determine program outcomes, the Data Science program faculty will prepare a self-study which will allow its program committee to evaluate the status, effectiveness, and progress of the degree program; recognize and reflect on program strengths and weaknesses; identify important directions in the disciplines or professions that need to be addressed; and assess the relationships among and contributions to other academic programs and the overall mission of the University. One part of this study will be the inclusion of student data such as: awards and honors, and placement of graduates. It will also include summaries of student exit interviews, alumni surveys, and employer feedback surveys. The program will administer exit surveys to those graduating each term and yearly feedback surveys to alumni and employers as the program grows. Partnering with the Career Center and the Alumni Center will aid in tracking graduates and career placements post-graduation. The Career Center implements a yearly graduation survey that asks for employment details. The results of these student measures will be aggregated yearly, shared with the program's committee, and included in its self-study report.

Programmatic Accreditation

If applicable, provide a narrative or the accreditation prospectus detailing the plans and costs of pursuing programmatic accreditation as an appendix item. If applicable, provide a list of any relevant accredited programs

present within the proposed program's academic unit (e.g., college, division, etc.) and their current accreditation status.

Not applicable.

Licensure/Certification

If applicable, identify the state, professional, or industry certifications or licensures the program will prepare students to meet. If applicable, explain how the proposed program will prepare students to pass state or industry licensures related to the degree. If applicable, confirm communication with the associated regulating authorities regarding the development of the proposal.

Not applicable.

If the program is an Educator Preparation Program, state whether the proposed program requires national recognition from a Specialized Professional Association (SPA).If so, describe the institution's plans to seek national recognition, including the expected timeline.
Not applicable.

High-Impact Learning Experiences and Student Success

Provide a narrative on how high-impact learning experiences (e.g., research, internship/externship, travel-study, service learning, civic engagement etc.) will be incorporated in both curricular and co-curricular components of the proposed program. When applicable, provide details for how the proposed program will ensure that all students have access (e.g., student grants, external funding, etc.) to high-impact learning experiences. Detail how the proposed program will leverage empirically demonstrated student success (e.g., wrap-around services, faculty mentorship, corequisite education, work-study, intrusive advising, peer-tutoring, etc.) initiatives to increase student outcomes. Detail how the proposed program will collaborate with career services to develop clear transition pathways for graduates.

Academic advisors are trained to discuss experiential learning opportunities with students at individual advising appointments each semester. The Undergraduate Research Office provides comprehensive resources, including links to university grants to support undergraduate research projects, a faculty mentor database, and opportunities to present. The university sponsors an annual Discovery Day where undergraduate researchers may present their work and earn prizes. The college supports student research through its Undergraduate Research Enhancement program: https://www.sc.edu/about/offices_and_divisions/undergraduate_research/index.php

For career development opportunities and internships, the Career Center provides numerous resources, including its Handshake portal for job and internship listings and mentoring; career coaching and workshops, and career fairs. The college sponsors several networking events each semester.
https://sc.edu/about/offices_and_divisions/career_center/index.php

For other experiential opportunities and resources, the Center for Integrative and Experiential Learning provides an experiential opportunity database, student grants to support beyond-the-classroom learning, and houses the university's nationally recognized Graduation with Leadership Distinction Program, a distinction that students earn

by completing a portfolio of beyond-the-classroom engagements prior to graduation.
https://sc.edu/about/initiatives/center_for_integrative_experiential_learning/index.php

The College of Arts and Sciences Office of Undergraduate Studies experiential learning staff work with units to promote and coordinate these and other, unit-sponsored opportunities and activities to students.

Transfer and Articulation

Identify any special articulation agreements for the proposed program and provide the articulation agreement or Memorandum of Agreement/Understanding. If none exist, for undergraduate programs, detail the timeline for how the proposed program will develop transfer pathways and/or formal articulation agreements with the most closely associated SCTCS, two-year public, or private institutions where the institution experiences the most transfer activity.

The attached transfer pathway from the A.S. with Concentration in Accelerated Mathematics from Midlands Technical College to the BS in Data Science demonstrates how 63 of the required 64 hours (all except the Midlands required COL-101 College Orientation) can transfer and allow for graduation on time. After the program is approved, we will engage with Midlands Technical College to finalize the transfer pathway. Similar guidance will be constructed for other institutions which send a sizeable number of transfer students to USC.

For other students, the USC Course Equivalency table provides transfer information on individual courses from other South Carolina institutions:
https://banner.onecarolina.sc.edu/BannerExtensibility/customPage/page/z_spg_codes-transferequiv?mepCode=COL

Credit Mobility
Provide a narrative detailing how the institution and the proposed program will facilitate credit mobility efforts (e.g., prior-learning assessments, digital learning records, stackable credentialing, mapping dual enrollment, credit by exam, course transfer, assessment of military or corporate training to credit, conversion of non-degree programs, portfolios, etc.) for students.

The University of South Carolina provides credits for:

- College Board Advanced Placement Program (AP), Cambridge International A Levels and higher level International Baccalaureate (IB) Diploma Programme.
  https://sc.edu/about/offices_and_divisions/undergraduate_admissions/requirements/for_freshmen/ap_ib_credits/

- College-Level Examination Program (CLEP) exams.
  https://sc.edu/about/offices_and_divisions/registrar/transfer_credits/clep_credits.php

- A maximum of 30 semester hours of credit by correspondence and credit awarded for educational experiences in the military may be applied toward meeting the requirements for a baccalaureate degree.
  https://sc.edu/about/offices_and_divisions/registrar/transfer_credits/military_experience_credit.php

- Coursework at other institutions (including Dual Enrollment credits) can be found on the Course Equivalency Table at https://sc.edu/about/offices_and_divisions/registrar/transfer_credits/course_equivalency.php

Faculty and Staff Resources

Administrative Resources

Detail the administrative structure of the proposed program and, if applicable, how administrative and teaching duties will be distributed among faculty. For shared programs (e.g., interdisciplinary programs that may reside between multiple academic units at an institution), provide documentation of support from the associated academic leadership in each academic unit.

The Data Science, B.S. program will reside in the College of Arts and Sciences (CAS) and will work closely with the College of Engineering and Computing (CEC). An Undergraduate Director, compensated and appointed by the CAS Dean in consultation with CEC, will have direct oversight of the degree with an undergraduate committee comprised of faculty from the core units of Math, Statistics, and Computer Science and other units participating in degree offerings. We anticipate this degree running in a similar manner to other interdisciplinary degrees in CAS. Teaching duties will be assigned by the respective department housing each course (or by the department of the instructor for cross-listed courses). The College of Arts and Sciences has already committed funding to support full-time professional academic advisors for all undergraduate students in the college.

See attached letters of support from the Departments of Computer Science and Engineering, Mathematics, and Statistics.

Faculty Resources

Table 5 – Proposed Faculty Roster

Rank	Full-Time or Part-Time	New or Existing Faculty	Academic Degrees	Other Qualifications and Relevant Professional Experience	Courses Taught for the Proposed Program
Professor	Full-Time	Existing	Ph.D. Computer Science - Duke University	Research in Bayesian Networks	CSCE 582
Professor	Full-Time	Existing	Ph.D. Computer Science - SUNY Stony Brook	Research in Machine Intelligence	CSCE 567, CSCE/STAT 587
Professor	Full-Time	Existing	Ph.D. Math - Iowa State University	Research in Numerical Analysis	MATH 344, 544, MATH/STAT 511
Professor	Full-Time	Existing	Ph.D. Math - Princeton University	Research in Applied Math	MATH 344, 524, 544
Professor	Full-Time	Existing	Ph.D. Math - SUNY Stony Brook	Research in Computational Biology	MATH 344, 524, 544
Professor	Full-Time	Existing	Ph.D. Math - UC San Diego	Research in Discrete Math	MATH 374, 572, 574

Professor	Full-Time	Existing	Ph.D. Math - UC San Diego	Research in Discrete Math	MATH 374, 574
Professor	Full-Time	Existing	Ph.D. Math - University of South Carolina	Research in Discrete Math	MATH 374, 574
Professor	Full-Time	Existing	Ph.D. Math - University of Wyoming	Research in Numerical Analysis	MATH 544, MATH/STAT 511
Professor	Full-Time	Existing	Ph.D. Math. - Ohio State University	Research in Modeling and Computation	MATH 344, 528, 529
Professor	Full-Time	Existing	Ph.D. Math. - Univ. of Sofia, Bulgaria	Research in Numerical Analysis	MATH 529
Professor	Full-Time	Existing	Ph.D. Mathematics - Virginia Tech	Research in Numerical Analysis	MATH 344, 524, 544
Professor	Full-Time	Existing	Ph.D. Statistics - Florida State University	Research in High Dimensional Inference	STAT 512, MATH/STAT 511
Professor	Full-Time	Existing	Ph.D. Statistics - North Carolina State University	Research in Bayesian Networks	STAT 509
Professor	Full-Time	Existing	Ph.D. Statistics - North Carolina State University	Research in Categorical Data	MATH/STAT 511
Associate Professor	Full-Time	Existing	Ph.D. Math - University of Delaware	Research in Computational Biology	MATH 344, 544
Associate Professor	Full-Time	Existing	Ph.D. Math - University of Maryland	Research in Applied Math	MATH 344, 544
Associate Professor	Full-Time	Existing	Ph.D. Statistics - Texas A&M	Research in High Dimensional Regression	STAT 515, 516, 530
Associate Professor	Full-Time	Existing	Ph.D. Statistics - University of Florida	Research in Multivariate Statistics	STAT 530, 535, 540, 541, 542
Associate Professor	Full-Time	Existing	Ph.D. Statistics - University of Illinois	Research in Multivariate Statistics	STAT 515, 516, 530
Associate Professor	Full-Time	Existing	Ph.D. Statistics - University of Missouri	Research in Bayesian Computing	STAT 515, 517, 540, 541

Associate Professor	Full-Time	Existing	Ph.D. Statistics - University of Missouri	Research in Graphical Models	STAT 516, 519, 535
Associate Professor	Full-Time	Existing	Ph.D. Biostatistics - Johns Hopkins University	Research in Genomics	BIOL/STAT 588
Assistant Professor	Full-Time	Existing	Ph.D. Computer Science - UC Irvine	Research in Artificial Intelligence	CSCE 580
Assistant Professor	Full-Time	Existing	Ph.D. Dublin City University	Research in Artificial Intelligence	CSCE 585
Assistant Professor	Full-Time	Existing	Ph.D. Math - Carnegie Mellon University	Research in Discrete Math	MATH 572, 574, MATH/STAT 511
Assistant Professor	Full-Time	Existing	Ph.D. Mathematics - Georgia Tech	Research in Data Science	MATH 528, 572
Assistant Professor	Full-Time	Existing	Ph.D. Statistics - University of Florida	Research in Machine Learning	STAT 517, 542, CSCE/STAT 587
Assistant Professor	Full-Time	Existing	Ph.D. Statistics - University of Wisconsin	Research in Computational Statistics	STAT 509, 519, CSCE/STAT 587
Assistant Professor	Full-Time	New	Ph.D. in Mathematics or Data Science	Research in Data Science	MATH 344, 374, 524, 528, 529, and/or 572
Assistant Professor	Full-Time	New	Ph.D. in Mathematics or Data Science	Research in Data Science	MATH 344, 374, 524, 528, 529, and/or 572
Assistant Professor	Full-Time	New	Ph.D. in Statistics or Data Science	Research in Data Science	STAT 515, 516 530, 535, 542, and/or 587
Assistant Professor	Full-Time	New	Ph.D. in Statistics or Data Science	Research in Data Science	STAT 515, 516 530, 535, 542, and/or 587
Instructor	Full-Time	Existing	M.S. Mathematics - University of South Carolina	Experience as Business Intelligence Analyst	CSCE 567
Graduate Students	Part-Time	Existing	Ph.D. Candidates in Applied MATH	Research in Applied Math	MATH 344L

If applicable, detail the need for new full-time and part-time faculty. Include the following: Quantify the amount of new faculty and instructional staff FTE positions; estimated compensation required; and a

narrative of how these positions will support the new program. If applicable, provide the performance indicators (e.g., credit hours produced per faculty, etc.) used to determine the need for faculty. For graduate programs, provide the number of graduate assistantships and their projected compensation, if applicable.

The existing proposed program faculty can absorb an influx of new students in the short term. However, offering additional sections of the required program and major courses and having regular offerings of the electives in the face of increases in Mathematics and Statistics majors and service course loads from other programs makes this unsustainable without additional faculty in the long term. The budget below also includes a salary estimate for four new faculty in the areas of Mathematics and Statistics as the program expands. This cost is covered by reallocation of existing funds from the College of Arts and Sciences.

These faculty will allow for one additional section each of the required MATH 344, 374, 528, 572, STAT 515, 516, 542, 587, and two STAT major electives, one MATH major elective, and one sections from the calculus sequence to help absorb the increase in enrollment there. The standard course load in the Department of Mathematics and Department of Statistics is 4 per year. The calculation above assumes that the faculty will average a one course reduction each due to administrative and external grant releases. The presence of these faculty will also help support the concurrently proposed Data Analytics program (directly in the case of MATH 572 and STAT 542 and 587, and indirectly by reducing scheduling pressure on the two departments.

Non-Instructional Staff
Provide a list of required existing and anticipated non-instructional staff positions dedicated to the proposed program, along with a narrative of how these positions will support the new program.

The program does not anticipate a need for additional non-instructional staff. Academic advising is centralized through the University Advising Center, and the College has additional full-time advisors already in place to assist with student needs.

Student Support Services
Provide an overview of student support services that will be available to all students in the proposed program (e.g., academic advising, tutoring, internship placement, career counseling, or others). Identify new services needed and provide any estimated costs associated with these services.

USC Columbia is committed to providing reasonable accommodations for students with disabilities. Students with disabilities must contact the Student Disability Resource Center prior to beginning or early in their academic program to determine if they are eligible for reasonable accommodations.

The Office of Student Affairs and Academic Support provides students with a variety of programs and resources in the areas of academic success, career preparation, involvement and leadership, and well-being. USC Columbia has a writing center to help students at any stage of the writing process. USC Columbia also has a Student Success Center that facilitates student learning and degree completion by providing a comprehensive array of programs, resources and services that advance academic goal-setting, skill development, personal transition to and within the university setting and effective decision making. The Student Success Center's services include study and writing support, financial consultations, population specific support, academic engagement resources, and various workshops in the areas of

support provided. In addition, the USC Columbia Career Center is dedicated to supporting students' needs at all stages of the process, by providing students with a number of resources including career exploration, resume and cover letter consultations, assistance with job search strategies, career coaching appointments, professional headshots, and professional clothing. From the basics of exploring major and career options and writing a resume, to connecting with employers for internships and interviews, USC students have access to career coaches and a premiere collection of online tools. Student Health Services provides students with a variety of resources to support their mental and emotional health and well-being in a variety of areas including COVID-19, emotional wellness, environmental wellness, financial wellness, intellectual wellness, occupational wellness, physical wellness, social wellness, and spiritual wellness. USC also provides many mental health resources including emergencies and after-hour counseling and psychiatry, information for the 24-hour National Suicide Prevention Hotline, the Crisis Text Line, the Trevor Lifeline, and online mental health services. The Division of Information Technology provides students with assistance in a variety of resources and platforms such as Blackboard, Carolina Tech Zone, Password Help, Self-Service Portal, and the Service Desk.

Clinical, Observation, Internship, or Research Site Procurement
If applicable, provide the plan for how the proposed program will ensure procurement of the requisite number of clinical, observation, internship, or research locations and partners.

Not applicable.

Institutional Resources

Equipment
Assess the adequacy of existing equipment available for the proposed program. Provide a narrative for additional equipment necessary for the program.

The program faculty are from the existing departments of Mathematics, Statistics, and Computer Science and Engineering. No need for additional equipment is expected beyond the start-up expenses contained in the budget for the proposed new faculty members.

In terms of computing, most software used in the program is available free of charge to use on their own computers and also available in University computer labs: CSCE 206 uses the free Virtual Studio Code with the two standard Python extensions and Python interpreter; CSCE 567 and STAT 515, 516, 530, and 542 use the open source R and RStudio; CSCE 567 uses Tableau, which provides a free product key for students

In addition to R and RStudio, CSCE/STAT 587 use the open-source Hadoop, MapReduce, Pig, and Hive. For larger data sets these are preloaded on virtual machines supported by the Computer Science and Engineering Department servers and remotely accessed via the university virtual private network. The CSE Department has server space to accommodate the expected increase in enrollment. MATH 344L, 528, 529, and 572 are currently available in computer labs on campus through the University. Student licenses are $75 per year should students decide they want to install the software on their own computers.

Facilities

Describe facilities that will support the proposed program. For existing space and facilities, briefly describe the type(s) of space and facilities (e.g., a listing of the number and types of classrooms or labs, student offices or spaces, etc.). If new construction is required for the proposed program, provide an update on the state approval and funding for the new construction including confirmation of any request to the CHE Committee on Finance and Facilities for consideration.

The program faculty are from the existing departments of Mathematics, Statistics, and Computer Science and Engineering. As noted in the budget, it is expected that eventually four additional faculty in Mathematics and Statistics will be hired; LeConte College (which houses the Departments of Mathematics and Statistics) is expected to have office space available. The number of students expected in this program will not cause a need to increase the currently available class space on campus.

Library and Learning Resources

Explain how current library/learning collections, databases, resources, and services specific to the discipline, including those provided by PASCAL, can support the proposed program. Identify additional library resources needed.

The University of South Carolina Library is the 40th largest library in the United States. It currently serves the program faculty from the existing departments of Mathematics, Statistics, and Computer Science and Engineering (as well as faculty in other departments) who actively research in Data Science, Machine Learning, and Artificial Intelligence. Reference librarians are available during normal operating hours. Reference and literature search requests are accepted in-person, by telephone, or online. Assistance is offered in locating materials, computerized bibliographic searches, identifying authoritative web sites with quality content, using local databases, interlibrary loan requests, class presentations, and advice on library services and policies. The Digital Research Librarians will be particularly useful for this program. Students also have access to additional library collections, databases, and resources provided by PASCAL. Current library resources are adequate to support the proposed program and no additional library resource needs are expected.

Impact on Existing Programs

If the proposed program will impact existing degree programs or services at the institution (e.g., course offerings or enrollment), identify those programs and explain the impact.

This program is expected to be attractive to some students currently in the Departments of Mathematics, Statistics and Computer Science and Engineering at USC. However, as stated earlier in the proposal, we do not expect the new program to significantly impact existing programs based on a review of programs at peer/peer-aspirant institutions. In Fall 2022, 118 students were enrolled in the B.S., Mathematics (147 including double majors); 78 were enrolled in the B.S. in Statistics (86 including double majors); 170 in the BSE, Computer Engineering; 208 in the B.S., Computer Information Systems; and 598 in the BSCS Computer Science. All of these programs will still have healthy enrollments even if they suffer some attrition. Double majoring between Data Science and either Mathematics or Statistics will work similarly to the currently popular double major between Mathematics and Statistics. (A student wishing for a Computer Science/Engineering/Information Systems degree and Data Science degree obtain dual degrees as the programs are in different colleges).

The Data Science degree is comprised entirely of existing courses – except for STAT 542 which is also being used as an elective for the Statistics BS. The remaining courses are predominantly in Mathematics and Statistics and the proposed budget includes two new faculty for each department as the program grows in order to maintain course offerings and class sizes for those two departments.

Fiscal Projections

Table 6 – Financial Projections

Projected One-Time Start-Up Expenses						
Category	Planning	Year 1	Year 2	Year 3	Year 4	Year 5
Faculty & Instructional Staff		$30,000	$45,000	$60,000	$60,000	$30,000
Non-Instructional Staff						
Graduate Assistants						
Accreditation						
Consultants						
Equipment						
Information Technology						
Library resources						
Marketing						
Facilities						
Travel						
Other						
Total Start-Up Expenditures	$0	$30,000	$45,000	$60,000	$60,000	$30,000
Projected New Recurring Expenses						
Category	Planning	Year 1	Year 2	Year 3	Year 4	Year 5
Faculty & Instructional Staff		$140,217	$269,878	$410,095	$539,756	$539,756
Non-Instructional Staff						
Graduate Assistants						
Accreditation						
Consultants						
Equipment						
Information Technology						
Library resources						

Marketing						
Facilities						
Travel						
Other (USC Participation Tax)		$13,692	$41,075	$75,304	$109,532	$130,069
Total Recurring Expenditures		$153,909	$310,953	$485,399	$649,288	$669,825
Grand Total (Start-Up and New Recurring)		$183,909	$355,953	$545,399	$709,288	$699,825
Projected Revenue						
Category	Planning	Year 1	Year 2	Year 3	Year 4	Year 5
Tuition and Fees		$80,538	$241,614	$442,959	$644,304	$765,111
Grants						
Institutional Reallocations		$170,217	$314,878	$470,095	$599,756	$569,756
Other (e.g., Federal or state appropriations, etc.)						
Total Revenues		$250,755	$556,492	$913,054	$1,244,060	$1,334,867
Net Totals (Revenue-Expenses)		$66,846	$200,539	$367,655	$534,772	$635,042

Utilizing Table 6, provide a detailed narrative of projected expenses and revenues. If a category anticipates an expense(s) greater than $10,000 in a given year, provide a detailed explanation of the expense. Items should match the narrative for the proposed program provided elsewhere in the proposal. Tuition and fees, grants, institutional reallocation, and other revenue should align with anticipated enrollment projections and any other identified revenue sources in the proposal. Include an analysis of cost-effectiveness and return on investment and address any impacts to tuition, other programs, services, facilities, and the institution overall.

All figures in the budget are in 2022-2023 costs unadjusted for inflation. The budget's tuition funding follows the enrollment projections in the preceding enrollment table and assumes that 60% of students are paying in-state tuition and 40% are paying out of state tuition at the full-time semester rate. 17% of projected tuition revenue is included as an “other” cost to accommodate for the USC Participation Tax (funding provided to administration to support service units). The program costs also include a salary estimate for approximately four faculty in the areas of Math and Statistics (one added each of years 1 to 4). A one-time startup cost spread over three years associated with each hire is included. The costs are covered by reallocation of existing funds from the College of Arts and Sciences. The College has already dedicated funds to support advising, recruitment and marketing for all programs, so additional costs are not expected.