# http://www.ric.edu/webcommunications/images/SealWithText_Small_Black.pngUNDERGRADUATE CURRICULUM COMMITTEE (UCC)PROPOSAL FORM

## Cover page scroll over blue text to see further important [instructions](#instructions): [if not working select “COMMents on rollover” in your Word preferences under view] please read these.

**N.B. DO NOT USE HIGHLIGHT, where choices are given within categories, please DELETE those THAT DO NOT APPLY TO YOUR PROPOSAL. Do not delete numbered categories.**

**ALL numbers in section (A) to be completed, including the impact ones (#5-7), put “none” if that is the case.**

|  |  |  |
| --- | --- | --- |
| A.1. [Course or program](#Proposal) | **Bachelor of science in Data science** |  |
|  |  |
| A.2. [Proposal type](#type) | **Program:** [**creation**](#creation) **|**  |
| A.3. [Originator](#Originator) | **Stephanie Costa and Rebecca Sparks** | [Home department](#home_dept) | **Mathematics and Computer Science** |
| A.4. [Context and Rationale](#Rationale)  | **With the evolution of the digital age came the demand for workers who can effectively analyze large volumes of data in order to gain inference from the data and use it to make informed decisions. From this demand, the field of Data Science was created. While definitions vary, most describe the field as an interdisciplinary one which uses expertise in Mathematics, Statistics, Computer Science, and a domain area to gain insight from data.****According to a 2018 report from the Department of Labor’s Bureau of Labor Statistics, careers in the Mathematical Sciences are expected to grow by almost 28 percent from 2016 to 2026, far outpacing the average growth rate for all occupations (2). In September 2019, Burning Glass Technologies, a leading provider of labor market data, published a report based on a three-year study of millions of online job postings in the US. The report ranked data science skills fifth highest in the category of fastest growing skills in online job postings. From 2015-2018, the number of mentions of data science in online job postings increased by 33% with 162,000 mentions in 2018(3).** **We believe that a major in Data Science will better position our graduates for success in the workforce. Our program is based on curriculum guidelines for undergraduate degrees in data science which have been endorsed by the American Statistical Association (ASA) (1). The guidelines were developed in 2016 by a group of 25 mathematicians, statisticians, and computer scientists from various liberal arts and research institutions of higher education.****Our proposed program focuses on both the theory and applications of concepts in Mathematics, Statistics, and Computer Science. Students will gain a strong foundation in mathematics and statistics, as well as strong programming and algorithmic thinking skills. Students will use these skills to solve problems and gain inference from data from a variety of domains. The solid foundation in all three areas is necessary to produce students with both strong content knowledge and the critical and creative thinking skills necessary to adapt and grow with changes in the field.****The core Mathematics courses in the major are Math 212, Math 213, Math 314 (Calculus I-III), Math 441 (Probability), and Math 436 (Discrete Mathematics).** **The Statistics core is comprised of Math 240 (Statistical Methods I), Math 245 (Principles of Data Science), Math 345 (Linear Models for Data Science), and Math 445 (Advanced Statistical Methods).****Finally, CSCI 157(Introduction to Algorithmic Thinking in Python), CIS 470 (Introduction to Data Science), and CSCI 455(Database Systems) make up the Computer Science core.****Data scientists should be able to effectively communicate their findings from data. Additionally, due to the sensitive nature of data, data scientists are expected to use data ethically and responsibly. Thus, we have proposed that all majors take English 230 (Writing for Professional Settings) and** **PHIL 207 (Technology and the Future of Humanity).****After considering our current course offerings and the guidelines of the ASA, we determined that we would need to create two new courses to provide students with the skills and data experiences necessary for the degree. The first new course, CSCI 428: Machine Learning introduces students to machine learning algorithms and applies the algorithms to a variety of problems. The second course, Math 460: Seminar in Data Science, serves as a capstone experience where students choose a scientific question, formulate a hypothesis, and then collect, organize, analyze, and interpret data in order to support or reject their original hypothesis. Students will be expected to use a high-level programming language for data analysis and effectively communicate their findings in writing.****Students completing this program will automatically have a minor in Mathematics and would only need two or three additional courses to earn a minor in Computer Information Systems or Computer Science, respectively.** 1. De Veaux, R. Agarwal, M., Averett, M., Baumer, B., Bray, A., Bressoud, T., …, Ye, P., 2016, ‘Curriculum Guidelines for Undergraduate Programs in Data Science’, Retrieved October 4, 2019 (<https://www.amstat.org/asa/files/pdfs/EDU-DataScienceGuidelines.pdf>).
2. Rieley, M., ‘Big data adds up to opportunities in math careers’, Beyond the Numbers: Employment & Unemployment, vol. 7, no. 8 , U.S. Bureau of Labor Statistics, 2018, Retrieved October 4, 2019 (<https://www.bls.gov/opub/btn/volume-7/big-data-adds-up.htm>).
3. Strack, R., Kaufman, E., Kotsis, A., Singelman, M., Restuccia, D., Taska, B., 2019, ‘What’s Trending in Jobs and Skills’, Retrieved October 4, 2019 (<https://www.bcg.com/publications/2019/what-is-trending-jobs-skills.aspx>)
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| A.5. [Student impact](#student_impact) | **The demand for data analysts, trained in machine or statistical learning,****is at an all-time high. It has been reported that the highest starting salaries****(in excess of 100K) for college graduates in 2019 was for data science majors.** **At a recent state-wide data science roundtable discussion, representatives from the RI Department of Labor and Training, The RI Tech Collective, and Providence based company Johnson & Johnson, talked about the need for well-educated data science graduates to meet local industry needs. The creation of this program will prepare our students for a high-demand, high-paying career.** |
| A.6. [Impact on other programs](#impact)  | **The Department of Accounting and Computer Information Systems offers a minor in Data Science. The mathematics and statistics requirement for the minor are at the introductory level. Our program, which builds upon the CIS minor by using their two data science courses (CIS 470 and CIS 472), would offer students the opportunity to gain an understanding of the mathematical and statistical theory behind the models and has a more substantial computer programming requirement. We hope that by adding the major we will increase the visibility of the field to our students which would benefit both the Data Science minor and the proposed major.** **The Philosophy and English Departments may see increased enrollments in PHIL 207 and ENGL 230, respectively, as these courses will be required for the BS in Data Science.** |
| A.7. [Resource impact](#Resource) | [*Faculty PT & FT*](#faculty):  | **None.** |
| [*Library*:](#library) | **None.** |
| [*Technology*](#technology) | **None, existing software packages will be utilized.** |
| [*Facilities*](#facilities): | **None, existing computer labs will be utilized.** |
| A.8. [Semester effective](#Semester_effective) | **Fall 2020** | A.9. [Rationale if sooner than next Fall](#Semester_effective) |  |
| A.10. INSTRUCTIONS FOR CATALOG COPY: This single file copy must include ALL relevant pages from the college catalog, and show how the catalog will be revised. (1) Go to the “Forms and Information” page on the UCC website. Scroll down until you see the Word files for the current catalog. (2) Download ALL catalog sections relevant for this proposal, including course descriptions and/or other affected programs. (3) Place ALL relevant catalog copy into a single file. Put page breaks between sections and **delete any catalog pages not relevant for this proposal**. (4) Using the track changes function, revise the catalog pages to demonstrate what the information should look like in next year’s catalog. (5) Check the revised catalog pages against the proposal form, especially making sure that program totals are correct if adding/deleting course credits. If new copy, indicate where it should go in the catalog. If making related proposals a single catalog copy that includes all is acceptable. Send as a separate single file along with this form. |

### C. [Program Proposals](#program_proposals) **complete only what is relevant to your proposal. Delete this whole page if the proposal is not revising, creating, deleting or suspending any progam.**

|  | [Old (for revisions only)](#old_program) | New/revised |
| --- | --- | --- |
| C.1. [Enrollments](#enrollments) |  | **20 students** |
| C.2. [Admission requirements](#admissions) |  | **We will be using RIC admissions requirements** |
| C.3. [Retention requirements](#retention) |  | **We will be using RIC retention requirements** |
| C.4. [Course requirements](#course_reqs) for each program option. Show the course requirements for the whole program here. |  | **Major Requirements:****MATH 212 (Calculus I) 4 cr,****MATH 213 (Calculus II) 4cr,****MATH 240 (Statistical Methods I) 4cr,****MATH 245 (Principles of Data Science) 4cr** **MATH 314 (Calculus III) 4 cr****MATH 345 (Linear Models for Data Science) 4 cr****MATH 436 (Discrete Mathematics) 3 cr****MATH 441 (Probability), 4 cr****MATH 445 (Advanced Statistical Methods), 4cr****MATH 460 (Seminar in Data Science), 3cr (new)** **CSCI 157 (Intro to Algorithmic Thinking in Python), 4cr****CIS 470 (Introduction to Data Science), 4cr****CIS 455 (Database Programming), 4 cr or CSCI 455 (Introduction to Database Systems), 3cr****CIS 472 (Data Visualization), 4 cr****CSCI 428 (Machine Learning), 4 cr (new)****PHIL 207 (Technology and the Future of Humanity) 3cr****ENGL 230 (Writing for Professional Settings) , 4cr** |
| C.5. [Credit count](#credit_count) for each program option |  | **65-66** |
| C.6. Other changes if any |  |  |
| C.7 [Program goals](file:///C%3A/Users/sabbotson/Documents/Curriculum/Program%20goals)Needed for all new programs |  | **1. Students will acquire a background in the content and methodology of mathematics, computer science, and statistics.** **a. Students will understand and use concepts and techniques in calculus, linear algebra, probability, and discrete mathematics.** **b. Students will understand and use algorithmic thinking and programming in a high-level language.****c. Students will understand and use concepts and techniques in data collection, analysis, modeling, and statistical inference.** **2. Students will apply knowledge in mathematics, statistics, and computer science to solve problems.** **a. Student will choose, fit, and use mathematical models to solve problems.****b. Students will use a high-level language to explore, visualize, and form hypotheses about data.****c. Students will understand the connections between the knowledge domains of mathematics, computer science and statistics and use a variety of skills from these domains to solve problems.** **3. Students will conduct data-based investigations and effectively communicate their findings.** **a. Students will receive raw data from a variety of sources and formats and then clean, transform, and structure the data for analysis.****b. Students will communicate data-based findings visually, orally, and in writing.****c. Students will gain exposure to the ethical questions related to data science such as citation and data ownership and the security of data.** |

## D. Signatures

* Changes that affect General Education in any way MUST be approved by ALL Deans and COGE Chair.
* Changes that directly impact more than one department/program MUST have the signatures of all relevant department chairs, program directors, and their relevant dean (e.g. when creating/revising a program using courses from other departments/programs). Check UCC manual 4.2 for further guidelines on whether the signatures need to be approval or acknowledgement.
* Proposals that do not have appropriate approval signatures will not be considered.
* Type in name of person signing and their position/affiliation.
* Send electronic files of this proposal and accompanying catalog copy to curriculum@ric.edu and a printed signature copy of this whole form to the current Chair of UCC. Check UCC website for due dates.

##### D.1. Approvals: required from programs/departments/deans who originate the proposal. may include multiple departments, e.g., for joint/interdisciplinary proposals.

| Name | Position/affiliation | [Signature](#_Signature" \o "Insert electronic signature, if available, in this column) | Date |
| --- | --- | --- | --- |
| Stephanie Costa | Chair of Mathematics and Computer Science |  |  |
| Alison Shonkwiler | Chair of English |  |  |
| Aaron Smutts | Chair of Philosophy |  |  |
| Lisa Bain | Chair of Accounting and Computer Information Systems |  |  |
| Jeff Mello | Dean of School of Business |  |  |
| Earl Simson | Dean of Arts and Sciences |  |  |

##### D.2. [Acknowledgements](#acknowledge): REQUIRED from OTHER PROGRAMS/DEPARTMENTS (and their relevant deans if not already included above) that are IMPACTED BY THE PROPOSAL. SIGNATURE DOES NOT INDICATE APPROVAL, ONLY AWARENESS THAT THE PROPOSAL IS BEING SUBMITTED. CONCERNS SHOULD BE BROUGHT TO THE UCC COMMITTEE MEETING FOR DISCUSSION; all faculty are welcome to attend.

| Name | Position/affiliation | [Signature](#Signature_2) | Date |
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