Proposal for New Program: 
BS in Data Science: Computational Analytics

1. “Rationale…” The proposed “Data Science: Computational Analytics” major is designed for students interested in developing expertise in data science, with specialization in computational analytics. Data Science is an interdisciplinary discipline about methods and systems to extract knowledge or insights from large quantities of data coming in various forms. Data science employs techniques and theories drawn from many fields within the broad areas of mathematics, statistics, and computer and information sciences and applies them on a wide range of data-rich domains such as biomedical sciences, physical science, geoscience, social science, engineering, business, and education.

Data science is a very broad and multifaceted field and it is not realistic to expect that a B.S. program could provide students with deep expertise in all aspects of the field. The “Computational Analytics” specialization will give students a strong background in mathematics, algorithmic and computational thinking, computer systems, and data analysis, and will enable students to analyze large quantities of data to discover new knowledge and facilitate decision making.

Graduates of this program will have multiple career opportunities. Some of them will choose to find data science jobs in a private or a public sector and some will choose to continue with graduate studies either to deepen their overall data science expertise or learn how to better use their analytics skills in a particular data-rich domain.

a. “regional and national competitors…” Following the rapid growth of the field, there is an increasing number of undergraduate and graduate programs in data science. Currently, there are more M.S. than B.S. level programs in data science in the US. The proposed program is the most similar to the Ohio State University “Data Analytics: Computational Analytics” major (https://data-analytics.osu.edu/major/specialization/computational-analytics), which is probably the most prominent existing undergraduate degree in data science. New data science related programs are cropping up regionally. College of Computing and Informatics at Drexel University is introducing B.S. in Data Science in Fall 2016 (http://drexel.edu/cci/programs/undergraduate-programs/bs-datascience/). At the graduate level, in Fall 2015 Wharton School at Penn started offering online “Business Analytics” specialization at Coursera (https://news.wharton.upenn.edu/press-releases/2015/09/wharton-school-offer-new-business-analytics-specialization-coursera-online-learning-platform/), whose focus is on using data science in business domain. Villanova started offering an M.S. program that focuses on business analytics (https://www1.villanova.edu/villanova/business/graduate/specializedprograms/msa.html). The Rutgers School of Business in Camden is offering a two-day certificate program to provide working professionals with analytical skills that can help them solve business problems entitled “Unlocking the Mystery, Challenge and Opportunity of Big Data” (http://rdi2.rutgers.edu/news/rutgers-offering-certificate-program-big-data). Department of Political Science at Penn State is introducing B.S. degree in “Social Data Analytics” (http://soda.la.psu.edu/), which focuses on social sciences domain.
Proposal for New Program:

BS in Data Science: Genomics

1. “Rationale...” The proposed “Data Science: Genomics” major is designed for students interested in developing expertise in data science, with specialization in genomics. Data Science is an interdisciplinary field about methods and systems to extract knowledge or insights from large quantities of data coming in various forms. Data science employs techniques and theories drawn from many disciplines within the broad areas of mathematics, statistics, and computer and information sciences and applies them on a wide range of data-rich domains such as biomedical sciences, physical science, geoscience, social science, engineering, business, and education.

Data science is a very broad and multifaceted field and it is not realistic to expect that a B.S. program could provide students with deep expertise in all aspects of the field. The “Genomics” specialization will give students a strong background in mathematics, computational thinking, and biological data analysis, and will enable students to analyze large quantities of data to discover new knowledge and facilitate decision making. As part of the broader data science program, genomics is a critical track to include as a sub-area of focus for students interested in biology, ecology, evolution, human health and disease, and precision medicine. Over the past decade, the emergence of next-generation sequencing technologies has facilitated the rapid growth of genomic data; however, undergraduate training in big data management, big data processing, and big data analysis has not kept up with this rapid growth in large-scale genomic data generation.

Graduates of this program will have multiple career opportunities. Some of them will choose to find data science jobs in a private or a public sector and some will choose to continue with graduate studies either to deepen their overall data science expertise or learn how to better use their analytics skills in genomics.
Proposal for New Program:
BS in Data Science: Modeling Physical Systems

1. “Rationale...” The proposed “Data Science: Modeling Physical Systems” major is intended for students interested in understanding the fundamentals of computer science necessary to create computational models of complex systems and simulations of natural systems. Examples of relevant and important modern complex systems include safety testing simulations, climate models, stock market analysis, electronic chip design, predicting pharmaceutical side-effects, air traffic control systems, defense applications, and smart grid studies.

Data Science is an extremely broad and deep interdisciplinary field, and this specialization aims to equip a B.S. student with the tools necessary to create accurate, robust, and detailed models of real systems in a scientific or professional field. A strong core of mathematics, physics, computational methods and techniques, and data analysis will equip students with the basics necessary to model any complex physical system. Meanwhile, elective courses will allow students to specialize in a specific area and give them a head start in that area. The capstone project will give students tangible credentials, while studies in visualization techniques will provide skills needed to succinctly summarize and present data, and to promote their work.

A graduate of this program will be equipped to build computational models of important real-world systems in any field. The elective courses will allow each to student to focus their interests, increasing their employ-ability within a specific field, but without locking them into that field. A graduate of this program could continue on into graduate school, work in a research group, or join a private or public sector organization that has a need for modeling complex systems.
# Appendix A1
## Data Science: Computational Analytics BS Semester Sequence

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Codes</th>
<th>Course Names</th>
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<tbody>
<tr>
<td><strong>Freshman – Fall</strong> (16 cr.)</td>
<td>CIS 1068</td>
<td>Program Design and Abstraction (4 cr.)</td>
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<tr>
<td></td>
<td>CIS 1166</td>
<td>Mathematical Concepts in Computing I (4 cr.)</td>
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<td></td>
<td>Math 1041</td>
<td>Calculus I (4 cr.)</td>
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<tr>
<td></td>
<td>Gen Ed English 0802</td>
<td>(4 cr.)</td>
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<tr>
<td><strong>Freshman – Spring</strong> (17 cr.)</td>
<td>CIS 2168</td>
<td>Data Structures (4 cr.)</td>
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<td>Math 1042</td>
<td>Calculus II (4 cr.)</td>
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<tr>
<td></td>
<td>Gen Ed IH 0851</td>
<td>(3 cr.)</td>
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<tr>
<td></td>
<td>Gen Ed World Society (3 cr.)</td>
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<td>Gen Ed Race (3 cr.)</td>
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<td>CIS 2107</td>
<td>Computer Systems and Low-Level Programming (4 cr.)</td>
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<td>CIS 2166</td>
<td>Mathematical Concepts in Computing I (4 cr.)</td>
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<td>Math 2043</td>
<td>Calculus III (4 cr.)</td>
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<td>Elective (1-0 cr.)</td>
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<td><strong>Sophomore – Spring</strong> (14 cr.)</td>
<td>CIS 3223</td>
<td>Data Structures and Algorithms (4 cr.)</td>
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<td>CIS 3715</td>
<td>Principles of Data Science (4 cr.)</td>
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<td></td>
<td>Math 3031</td>
<td>Probability Theory I (3 cr.)</td>
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<td></td>
<td>Gen Ed IH 0852</td>
<td>(3 cr.)</td>
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<td>Math 3032</td>
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<td>Math 3045</td>
<td>Differential Equations with Linear Algebra (4 cr.) or Math 2101 Linear Algebra (3 cr.) or Math 2103 Linear Algebra with Lab (4 cr.)</td>
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<td>Gen Ed US Society (3 cr.)</td>
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<td>Elective (0-1 cr.)</td>
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<td>CIS 4517</td>
<td>Data-Intensive and Cloud Computing (4 cr.)</td>
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<td>Science A (4 cr.)</td>
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<td>DS: Computational Elective (3 cr.)</td>
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<td>Gen Ed Behavior (3 cr.)</td>
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<td><strong>Senior – Fall</strong> (16 cr.)</td>
<td>CIS 4526</td>
<td>Foundations of Machine Learning (3 cr.)</td>
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<td></td>
<td>Eng 2696</td>
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<td>Elective (3 cr.)</td>
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<td><strong>Senior – Spring</strong> (16 cr.)</td>
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<td>xx96 Advanced Data Visualization (3 cr.)</td>
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Credits in the major: 82-83  
Credits in General Education: 25-26  
Elective credits: 16-14  
Total credits: 123
## Appendix A2
### Data Science: Genomics BS Semester Sequence

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<thead>
<tr>
<th>Semester</th>
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<td><strong>Freshman – Fall (16 cr.)</strong></td>
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<tr>
<td>Chem 1031&amp;1033 General Chemistry I (3+1 cr.)</td>
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<td>CIS 1068 Program Design and Abstraction (4 cr.)</td>
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<td>Math 1041 Calculus I (4 cr.)</td>
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<td><strong>Freshman – Spring (15 cr.)</strong></td>
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<tr>
<td>Chem 1032&amp;1034 General Chemistry II (3+1 cr.)</td>
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<td>CIS 1166 Mathematical Concepts in Computing I (4 cr.)</td>
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<td><strong>Sophomore – Fall (17 cr.)</strong></td>
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<tr>
<td>Biol 1111 Introduction to Biology (4 cr.)</td>
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<td>Chem 2201&amp;2203 Organic Chemistry I (3+1 cr.)</td>
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<td>CIS 2168 Data Structures (4 cr.)</td>
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<td>Gen Ed IH 0852 (3 cr.)</td>
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<td>Biol 2112 Introduction to Biology (4 cr.)</td>
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<td>Chem 2202&amp;2204 Organic Chemistry II (3+1 cr.)</td>
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<td>Math 3031 Probability Theory I (3 cr.)</td>
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<td>Biol 2296S Genetics (4 cr.)</td>
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<td>CIS 3715S Principles of Data Science (4 cr.)</td>
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<tr>
<td>Biol 3111F Genomics in Medicine (3 cr.)</td>
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<td><strong>Senior – Spring (14 cr.)</strong></td>
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<td>SCTC5 xxxx Advanced Data Visualization (3 cr.)</td>
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Credits in the major: 80

Credits in General Education: 25-26

Elective credits: 18-17

Total credits: 123
### Appendix A3

**Data Science: Modeling Physical Systems BS Semester Sequence**

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<tr>
<th>Freshman – Fall (16 cr.)</th>
<th>Freshman – Spring (15 cr.)</th>
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<tbody>
<tr>
<td>CIS 1068 Program Design and Abstraction (4 cr.)</td>
<td>CIS 1166 Mathematical Concepts in Computing I (4 cr.)</td>
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<tr>
<td>Math 1041 Calculus I (4 cr.)</td>
<td>or Math 2111 Basic Concepts in Math (3 cr.)</td>
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<td>Phys 1061 Elementary Classical Physics I (4 cr.)</td>
<td>Math 1042 Calculus II (4 cr.)</td>
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<td>Gen Ed English 0802 (4 cr.)</td>
<td>Phys 1062 Elementary Classical Physics II (4 cr.)</td>
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<tr>
<td>CIS 2168 Data Structures (4 cr.)</td>
<td>CIS 2166 Mathematical Concepts in Computing I (4 cr.)</td>
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<td>Math 2043 Calculus III (4 cr.)</td>
<td>Math 3032 Probability Theory II (3 cr.)</td>
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<td>Math 3031 Probability Theory I (3 cr.)</td>
<td>Phys 2796 Introduction to Modern Physics (4 cr.)</td>
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<td>Gen Ed IH 0852 (3 cr.)</td>
<td>Gen Ed US Society (3 cr.)</td>
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<tr>
<th>Junior – Fall (15 cr.)</th>
<th>Junior – Spring (17 cr.)</th>
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<tbody>
<tr>
<td>CIS 3223 Data Structures and Algorithms (4 cr.)</td>
<td>CIS 3715 Principles of Data Science (4 cr.)</td>
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<tr>
<td>Math 3045 Differential Equations with Linear Algebra (4 cr.) or Math 2101 Linear Algebra (3 cr.) or Math 2103 Linear Algebra with Lab (4 cr.)</td>
<td>Phys 2502 Mathematical Physics (4 cr.)</td>
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<td>Gen Ed Arts (3-4 cr)</td>
<td>DS: Modeling Elective (3 cr.)</td>
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<td>Elective (3 cr.)</td>
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<td>Elective (2-0 cr.)</td>
<td>Gen Ed World Society (3 cr.)</td>
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<th>Senior – Fall (15 cr.)</th>
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<tr>
<td>Math 3043 Numerical Analysis I (3-4 cr.)</td>
<td>SCTC Advanced Data Visualization (3 cr.)</td>
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<td>Phys 2501 Computing for Scientists (3 cr.)</td>
<td>DS: Modeling Elective (3 cr.)</td>
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<td>Elective (4 cr.)</td>
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Credits in the major: 77-81
Credits in General Education: 25-26
Elective credits: 21-16
Total credits: 123
Appendix B1

New Data Science: Computational Analytics B.S. Degree.

Intro Science Requirements:
- Chem 1031&1033&1032&1034 General Chemistry I&II (3+1+3+1 cr.) OR Biol 1111&2112 Introduction to Biology I&II (4+4 cr.) OR Phys 1061&1062 (4+4 cr.) Elementary Classical Physics I&II (plus variants)

Subtotal 8 credits

Calculus Requirements:
- Math 1041 (4 cr.) Calculus I
- Math 1042 (4 cr.) Calculus II
- Math 2043 (4 cr.) Calculus III

Subtotal 12 credits

Math Methods in Computing Requirements:
- CIS 1166 (4 cr.) Mathematical Concepts in Computing I
- CIS 2166 (4 cr.) Mathematical Concepts in Computing II
- Math 3045 (4 cr.) Probability Theory I or Math 2101 (3 cr.) Linear Algebra or Math 2103 (4 cr.) Linear Algebra with Lab

Subtotal 11-12 credits

Probability and Statistics Requirements:
- Math 3031 (3 cr.) Probability Theory I
- Math 3032 (3 cr.) Probability Theory II

Subtotal 6 credits

Programming Requirements:
- CIS 1068 (4 cr.) Program Design and Abstraction
- CIS 2168 (4 cr.) Data Structures

Subtotal 8 credits

Specialty Course Requirements:
- CIS 2107 (4 cr.) Computer Systems and Low-Level Programming
- CIS 3223 (3 cr.) Data Structures and Algorithms
- CIS 3715 (4 cr.) Principles of Data Science
- CIS 4331 (4 cr.) Principles of Database Systems 4cr
- CIS 4526 (3 cr.) Foundations of Machine Learning
- CIS 4517 (4 cr.) Data-Intensive and Cloud Computing 4cr

Subtotal 28 credits

WI/Capstone Requirements:
- ENG 2696 (3 cr.) Technical Writing
- SCTC xxxx (3 cr.) Advanced Data Visualization

Subtotal 6 credits
Elective Course Requirements (9 credits required):

- BIOE 3301. (3 cr.) Biomedical Signals and Systems
- CEE 3048. (3 cr.) Probability, Statistics & Stochastic Methods
- CEE 3711. (3 cr.) Environmental Engineering
- CEE 4221. (3 cr.) Intelligent Transportation Systems
- CEE 4531. (3 cr.) Life Cycle Assessment and Carbon Footprinting
- CIS 3203. (3 cr.) Introduction to Artificial Intelligence
- CIS 3207. (4 cr.) Introduction to Systems Programming and Operating Systems
- CIS 3219. (4 cr.) Computer Graphics and Image Processing
- CIS 3515. (4 cr.) Introduction to Mobile Application Development
- CIS 3605. (3 cr.) Introduction to Digital Forensics
- CIS 4082 (max of 3 cr.) Independent Study
- CIS 4523/9664 (3 cr.) Knowledge Discovery and Data Mining
- CIS 4524 (3 cr.) Analysis and Modeling of Social and Information Systems (from Math)
- EES 3011 (4 cr.) Remote Sensing and GIS
- HCM 3501 (3 cr.) Introduction to Health Service Systems
- MATH 3043 (3-4 cr.) Numerical Analysis I
- MATH 3044 (3 cr.) Numerical Analysis II
- MATH 4033 (3 cr.) Probability Theory
- MATH 4043 (3 cr.) Applied Mathematics
- MKTG 3508 (3 cr.) Digital Marketing (has college restriction, MKTG 2101 as a prereq, ask for a permission)
- MKTG 3509 (3 cr.) Customer Data Analytics (has college restriction, has MKTG 2101 as a prereq, ask for a permission)
- Stat 2522 (3 cr.) Survey Design and Sampling
- Stat 2523 (3 cr.) Design of Experiments & Quality Control
- Stat 3504 (3 cr.) Time Series and Forecasting Models
- Stat 3506 (3 cr.) Nonparametric and Categorical Data Analysis

Subtotal 9 credits

Total 82-83 credits
Appendix B2

New Data Science: Genomics B.S. Degree.

Intro Science Requirements:
  Chem 1031&1033 General Chemistry I (3+1 cr.)
  Chem 1032&1034 General Chemistry II (3+1 cr.)
Subtotal 8 credits

Calculus Requirements:
  Math 1041 (4 cr.) Calculus I
  Math 1042 (4 cr.) Calculus II
Subtotal 8 credits

Math Methods in Computing Requirements:
  CIS 1166 (4 cr.) Mathematical Concepts in Computing I
  CIS 2166 (4 cr.) Mathematical Concepts in Computing II
Subtotal 8 credits

Probability and Statistics Requirements:
  Math 3031 (3 cr.) Probability Theory I
  Math 3032 (3 cr.) Probability Theory II
Subtotal 6 credits

Programming Requirements:
  CIS 1068 (4 cr.) Program Design and Abstraction
  CIS 2168 (4 cr.) Data Structures
Subtotal 8 credits

Specialty Course Requirements:
  Biol 1111 Introduction to Biology I (4 cr.)
  Biol 2112 Introduction to Biology II (4 cr.)
  Biol 3101 Evolution (3 cr.)
  Biol 3111 Genomics in Medicine (3 cr.)
  Chem 2201&2203 Organic Chemistry I (3+1 cr.)
  Chem 2202&2204 Organic Chemistry I (3+1 cr.)
  CIS 3715 (4 cr.) Principles of Data Science
Subtotal 26 credits

WI/Capstone Requirements:
  Biol 2296 Genetics (4 cr.)
  SCTC xxxx (3 cr.) Advanced Data Visualization
Subtotal 7 credits

Elective Course Requirements (9 credits required):
  Biol 2227 Principles Of Ecology (3 cr.)
Biol 3112 Foundations Of Evolutionary Genomic Medicine (3 cr.)
Biol 3114 Evolutionary Ecology (3 cr.)*
Biol 3128 Genomics and Infectious Disease Dynamics*
Biol 3201 Human Genetics (3 cr.)
Biol 3211 Human Evolution (3 cr.)
Biol 3225 Evolutionary Genetics (3 cr.)
Biol 3241 Genomics & Evolutionary Biology Of Parasites (3 cr.)
Biol 3225 Evolutionary Genetics (3 cr.)
Biol 3241 Genomics & Evolutionary Biology Of Parasites (3 cr.)
Biol 3321 Plant Community Ecology (3 cr.)*
Biol 3322 Plant Genetics (3 cr.)
Biol 3324 Molecular Biology (3 cr.)
Biol 3328 Virology (3 cr.)
Biol 3368 Biology of Cancer (3 cr.)**
Biol 3379 Biotechnology (3 cr.)**
Biol 3403 Genomics (3 cr.)
Biol 4xxx UG Computational Bio courses being developed (3 cr.)
CEE 3048 Probability, Statistics & Stochastic Methods (3 cr.)
CIS 4523/9664 Data Mining (3 cr.)

Subtotal 9 credits

Total 80 credits

*This course requires an additional prerequisite of BIOL 2227
**This course requires an additional prerequisite of BIOL 3096
Appendix B3

New Data Science: Modeling Physical Systems B.S. Degree

Intro Science Requirements:
- Phys 1061 (4 cr.) Elementary Classical Physics I (plus variants)
- Phys 1062 (4 cr.) Elementary Classical Physics II (plus variants)
Subtotal 8 credits

Calculus Requirements:
- Math 1041 (4 cr.) Calculus I
- Math 1042 (4 cr.) Calculus II
- Math 2043 (4 cr.) Calculus III
Subtotal 12 credits

Math Methods in Computing Requirements:
- CIS 1166 (4 cr.) Mathematical Concepts in Computing I or Math 2111 (3 cr.) Basic Concepts of Math
- CIS 2166 (4 cr.) Mathematical Concepts in Computing II
- Math 3045 (4 cr.) Probability Theory I or Math 2101 (3 cr.) Linear Algebra or Math 2103 (4 cr.) Linear Algebra with Lab
Subtotal 10-12 credits

Probability and Statistics Requirements:
- Math 3031 (3 cr.) Probability Theory I
- Math 3032 (3 cr.) Probability Theory II
Subtotal 6 credits

Programming Requirements:
- CIS 1068 (4 cr.) Program Design and Abstraction
- CIS 2168 (4 cr.) Data Structures
Subtotal 8 credits

Specialty Course Requirements:
- CIS 3223 (3 cr.) Data Structures and Algorithms
- CIS 3715 (4 cr.) Principles of Data Science
- Math 3043 (3-4 cr.) Numerical Analysis I
- Phys 2501 (3 cr.) Computing for Scientists
- Phys 2502 (4 cr.) Mathematical Physics
Subtotal 17-18 credits

WI/Capstone Requirements:
- Phys 2796 (4 cr.) Introduction to Modern Physics
- SCTC xxxx (3 cr.) Advanced Data Visualization
Subtotal 7 credits
Elective Course Requirements (9 credits required):
CEE 3048. (3 cr.) Probability, Statistics & Stochastic Methods
CIS 3219. (4 cr.) Computer Graphics and Image Processing
CIS 4523/9664 (3 cr.) Data Mining
CIS 4xxx/5245 Analysis and Modeling of Information Networks
CIS 4526 (3 cr.) Foundations of Machine Learning
EES 3011 (4 cr.) Remote Sensing and GIS
EES 4xxx/5xxx (3 cr.) Ice Sheet Dynamics (with permission)
Math 3044 (3 cr.) Numerical Analysis II
Math 4033 (3 cr.) Probability Theory
Math 4041 (3 cr.) Partial Differential Equations
Math 4043 (3 cr.) Applied Mathematics
Math 5043 (3 cr.) Grad Numerical Analysis
Phys 2101 (3 cr.) Classical Mechanics
Phys 3101 (3 cr.) Analytical Mechanics
Phys 3301 (4 cr.) Electricity and Magnetism
Phys 3302 (3 cr.) Classical Electricity and Magnetism
Phys 3701 (3 cr.) Introduction to Quantum Mechanics
Phys 4101 (3 cr.) Thermodynamics and Kinetic Theory or Elective
Phys 4302 (3 cr.) Optics
Phys 4701 (3 cr.) Intro to Solid State Physics
Phys 4702 (3 cr.) Atomic, Nuclear, & Particle Physics
Math 4082 (max of 3 cr. Across all indep. study) Independent Study
Phys 4091 (max of 3 cr. Across all indep. study) Independent Study
SCTC 21xx (3 cr.) Modeling and Simulation in Science & Technology

Total 77-81 credits
Appendix C

CST Data Science BS programs Common Core

- Chem 1031&1033&1032&1034 General Chemistry I&II (3+1+3+1 cr.) OR Biol 1111&2112 Introduction to Biology I&II (4+4 cr.) OR Phys 1061&1062 (4+4 cr.) Elementary Classical Physics I&II (plus variants)
- CIS 1068 (4 cr.) Program Design and Abstraction
- CIS 2168 (4 cr.) Data Structures
- CIS 1166 (4 cr.) Mathematical Concepts in Computing I
- CIS 2166 (4 cr.) Mathematical Concepts in Computing II
- Math 1041 (4 cr.) Calculus I
- Math 1042 (4 cr.) Calculus II
- Math 3031 (3 cr.) Probability Theory I
- Math 3032 (3 cr.) Probability Theory II
- CIS 3715 (4 cr.) Principles of Data Science
- SCTC xxxx (3 cr.) Advanced Data Visualization

Data Science: Computational Analytics BS Comparison to CST Data Science Common Core

Added
- Math 3045 (4 cr.) Probability Theory I or Math 2101 (3 cr.) Linear Algebra or Math 2103 (4 cr.) Linear Algebra with Lab
- CIS 2107 (4 cr.) Computer Systems and Low-Level Programming
- CIS 3223 (4 cr.) Data Structures and Algorithms
- CIS 4331 (4 cr.) Principles of Database Systems 4cr
- CIS 4526 (3 cr.) Foundations of Machine Learning
- CIS 4517 (4 cr.) Data-Intensive and Cloud Computing 4cr
- Math 2043 (4 cr.) Calculus III
- ENG 2696 (3 cr.) Technical Writing

Data Science: Genomics BS Comparison to CST Data Science Common Core

Changed
- Chem 1031&1033&1032&1034 General Chemistry I&II (3+1+3+1 cr.) (plus variants) specified

Added
- Biol 1111 Introduction to Biology I (4 cr.)
- Biol 2112 Introduction to Biology II (4 cr.)
- Biol 2296 Genetics (4 cr.)
- Biol 3101 Evolution (3 cr.)
- Biol 3111 Genomics in Medicine (3 cr.)
- Chem 2201&2203 Organic Chemistry I (3+1 cr.)
- Chem 2202&2204 Organic Chemistry I (3+1 cr.)
Data Science: Modeling Physical Systems BS Comparison to CST Data Science Common Core

**Changed**
- Phys 1061&1062 (4+4 cr.) Elementary Classical Physics I&II (plus variants) specified

**Added**
- Math 3045 (4 cr.) Probability Theory I or Math 2101 (3 cr.) Linear Algebra or Math 2103 (4 cr.) Linear Algebra with Lab
- CIS 3223 (4 cr.) Data Structures and Algorithms
- Math 2043 (4 cr.) Calculus III
- Math 3043 (3-4 cr.) Numerical Analysis I
- Phys 2501 (3 cr.) Computing for Scientists
- Phys 2502 (4 cr.) Mathematical Physics
- Phys 2796 (4 cr.) Introduction to Modern Physics

Comparison of CST Data Science BS programs Common Core to Statistics and Data Science BS

**Common**
- CIS 1068 (4 cr.) Program Design and Abstraction
- Math 1041 (4 cr.) Calculus I
- Math 1042 (4 cr.) Calculus II

**Alternates**
- CIS 2168 (4 cr.) Data Structures versus CIS 1051. Introduction to Problem Solving and Programming in Python (4 cr.)
- Math 3031 (3 cr.) Probability Theory I versus Stat 2103/2903 Statistics for Business Analytics (4)
- Math 3032 (3 cr.) Probability Theory II versus Stat 2512 Intermediate Statistics - (3)

**Statistics and Data Science BS only**
- BA 2196/2996 Business Communications – (3)
- BA 2104 Excel for Business Applications (1)
- HRM 1101/1901 Leadership and Organizational Management - (3)
- ECON 1102/1902 Microeconomic Principles (3)
- ECON 1101/1901 Macroeconomics Principles (3)
- RMI 2101/2901. Introduction to Risk Management – (3)
- MKTG 2101/2901. Marketing Management- (3)
- Acct 2101/2901 Financial Accounting- (3)
- Stat 2501 Quantitative Foundations for Data Science –(3) new course
- Stat 2521 Data Analysis and Statistical Computing- (3)
- Stat 2523 Design of Experiments & Quality Control- (3)
- Stat 2522 Survey Design and Sampling- (3)
- Stat 3503 Intermediate Business Statistics- (3)
- Stat 3505 Introduction to SAS for Data Analytics (3) – new course
- Stat 3502 Regression and Predictive Analytics(3) – new course
• Stat 3504 Time Series and Forecasting Models (3) – new course
• Stat 3506 Nonparametric and Categorical Data Analysis (3) – new course
• Stat 4501 Capstone: Statistical methods and Data Analytics (use of SAS (with Online certification) and R (3) – new course
• 2 elective courses

CST Data Science BS programs Common Core only
• Chem 1031&1033&1032&1034 General Chemistry I&II (3+1+3+1 cr.) OR Biol 1111&2112 Introduction to Biology I&II (4+4 cr.) OR Phys 1061&1062 (4+4 cr.) Elementary Classical Physics I&II (plus variants)
• CIS 1068 (4 cr.) Program Design and Abstraction
• CIS 1166 (4 cr.) Mathematical Concepts in Computing I
• CIS 2166 (4 cr.) Mathematical Concepts in Computing II
• CIS 3715 (4 cr.) Principles of Data Science
• SCTC xxxx (3 cr.) Advanced Data Visualization
• 7-8 required courses based on particular CST Data Science BS program
• 3 elective courses based on particular CST Data Science BS program

Comparison of Data Science: Computational Analytics BS to Computer Science BS

Removed
• CIS 1001 (New) (1 cr.) Freshman Seminar in Computer Science
• CIS 2033 (4 cr.) Computational Probability and Statistics
• CIS 3238 (4 cr.) Software Design
• CIS 4397 (4 cr.) Independent Research in Computer Science or CIS 4398 Projects in Computer Science (4 cr.)

Specified
• Chem 1031&1033&1032&1034 General Chemistry I&II (3+1+3+1 cr.) OR Biol 1111&2112 Introduction to Biology I&II (4+4 cr.) OR Phys 1061&1062 (4+4 cr.) Elementary Classical Physics I&II (plus variants) as Science A and Science B

Added
• Math 2043 (4 cr.) Calculus III
• Math 3031 (3 cr.) Probability Theory I
• Math 3032 (3 cr.) Probability Theory II
• Math 3045 (4 cr.) Probability Theory I or Math 2101 (3 cr.) Linear Algebra or Math 2103 (4 cr.) Linear Algebra with Lab
• CIS 3715 (4 cr.) Principles of Data Science
• CIS 4331 (4 cr.) Principles of Database Systems 4cr
• CIS 4526 (3 cr.) Foundations of Machine Learning
• CIS 4517 (4 cr.) Data-Intensive and Cloud Computing 4cr
• SCTC xxxx (3 cr.) Advanced Data Visualization