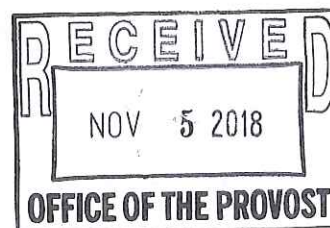




EPC PROPOSAL FORM



Originating Academic Unit: Computer Science

Date Proposal Submitted: November 01, 2018

INSTRUCTIONS: Upon completing the form, submit a hard copy with all appropriate signatures to the Office of the Provost. In addition, email a copy to EPC via the Faculty Governance Coordinator, Carol Bautista (facgov@plu.edu).

DEADLINES: Proposals are due Nov. 1 for fall/J-Term of the next academic year, Apr. 1 for the next spring/summer.

For specifics on the processing of each type of proposal, see '2. Flowchart of Usual Procedure for Curriculum Revision' and '5. Checklist for Developing Proposals' in the EPC Manual, found in the [Faculty Handbook](#) (Section III, Part VI).

☒ **TYPE 1: NON-SUBSTANTIVE CHANGES** [complete shaded sections and provide signatures]
Check boxes in this section. Then either complete Proposal summary and Catalog/Curriculum Changes sections on the next page and provide chair/dean signatures on final page, or attach a memo with chair/dean signatures.

- ☒ Change course number
- ☒ Change course title
- ☒ Change catalog description (no change in substance of course)
- ☐ Delete course with no GenEd element and not required by any major/minor/concentration
- ☐ Prerequisite change within the academic unit only
- ☐ Catalog correction (editorial)

☒ **TYPE 2: SUBSTANTIVE CHANGES** [complete all sections, including signatures]
Submit completed form, including signatures. Be sure to check all boxes that apply.
Note: All substantive changes to pre-existing courses require a change of course number.

- | | |
|--|--|
| <input type="checkbox"/> Modify existing course | <input type="checkbox"/> Change a course's credit hours |
| <input type="checkbox"/> Add permanent GenEd course ⁺⁺ | <input type="checkbox"/> Add GenEd Element to existing course ⁺⁺ |
| <input checked="" type="checkbox"/> Add permanent non-GenEd course ⁺⁺ | <input type="checkbox"/> Delete GenEd course |
| <input type="checkbox"/> Change in major requirement ^{**} | <input type="checkbox"/> Change in minor requirement ^{**} |
| <input type="checkbox"/> Revise curriculum ^{**} | <input type="checkbox"/> Change in concentration requirement ^{**} |
| <input type="checkbox"/> Other: _____ | <input type="checkbox"/> Prerequisite change involving another unit's course |

☒ **TYPE 3: CHANGES REQUIRING FACULTY ASSEMBLY APPROVAL** [complete all sections, including signatures]
Note: Some of these proposals require the approval of the Board of Regents in addition to the Faculty Assembly. Proposals for a new degree require attachment of the [Institutional Impact Evaluation Form](#).

- | | | | |
|---|--|---|--|
| <input type="checkbox"/> New Degree ^{**} | <input type="checkbox"/> New Major ^{**} | <input checked="" type="checkbox"/> New Minor ^{**} | <input type="checkbox"/> New Concentration ^{**} |
| <input type="checkbox"/> Eliminate Degree | <input type="checkbox"/> Eliminate Major | <input type="checkbox"/> Eliminate Minor | <input type="checkbox"/> Eliminate Concentration |
| <input type="checkbox"/> Other change | | | |

^{**} These changes/proposals require completion of the [EPC Curriculum Change Template](#).

⁺⁺ A course syllabus must be submitted with new course proposals.

PROPOSAL

Provide a summary of the proposal.

Change course prefix, number and description for introduction to data science (CSCI 133). Clarify/strengthen wording for Math prerequisites for an existing course. Addition of a new second course in data science, and a new Minor in Data Science.

STATEMENT OF RATIONALE

Provide a statement of rationale or other clarifications. Include information on student learning and outcomes and any General Education Program rationale.

Changes to CSCI 133:

- Change prefix and title to distinguish from CSCI courses and match/complement new DATA 233 course.
- Reword course description for clarity.
- Clarify/strengthen wording for Math prerequisites at the advice of the Mathematics department. Students who successfully complete 4 years of HS math should place into PLU MATH 151 or higher. If they do not, we believe they need to complete MATH 140 with a C or better to be successful in the course. This was the intent of the original prerequisite wording, and, in practice, students who have taken the course in the past have easily met this requirement. The new wording makes this expectation explicit and ensures future students will be prepared for the course.

See attachments for rationale for the Data Science Minor and draft course syllabus for DATA 233.

CATALOG/CURRICULUM CHANGES

Current Catalog Language:

Currently on the Computer Science page:

CSCI 133: Introduction to Computational and Data Science

Introduction to computer programming and problem-solving using real datasets from a variety of domains such as science, business, and the humanities. Introduces the foundations of computational thinking, modeling and simulation and data visualization using the Python programming language and R statistical package. Intended for students without prior programming experience. Prerequisite: four years of high school mathematics or MATH 140 or equivalent. (4)

Proposed Catalog Language: (note changes in **Bold)**

To be moved to a new Data Science page (proposed catalog language attached):

~~CSCI~~ **DATA 133: Introduction to Computational and Data Science I**

Introduction to computer programming and problem-solving using real datasets from a variety of domains such as science, business, and the humanities. Introduces the **basics of data science concepts through foundations** of computational thinking, modeling and simulation and data visualization using the Python programming language and R statistical **software package**. Intended for students without prior programming experience. Prerequisite: ~~four years of high school mathematics or~~ **Completion of PLU MATH 140 or an equivalent college-level course with a grade of C or better; or PLU mathematics placement into PLU MATH 151 or a higher numbered PLU mathematics course.** (4)

DATA 233: Introduction to Data Science II

Continuation of DATA 133, topics may include data manipulation, cleaning and visualization techniques, machine learning techniques, natural language processing, databases, text mining, data science ethics/privacy, etc. Students will collaborate with help of version control systems like

GitHub. Python is the main programming language used. Prerequisite: DATA 133 or CSCI 144.
Recommended: One of MATH/STAT 145, STAT 231, 232, 233, or MATH/STAT 242. (4)

For courses ...

Repeatable for credit: ☐ Yes, ? times ☒ No
Grade Type: ☒ Standard Letter ☐ Pass/Fail
Anticipated Enrollment: 25 for both DATA 133 and DATA 233
Course Syllabus Attached**: ☒ Yes ☐ No

**Required for new courses

Does the proposal include the addition to a course of one or more General Education Program elements (GenEd)?

☐ **Yes** (Check the appropriate boxes below)

If more than one course is proposed, make sure the proposal makes clear which GenEd elements, if any, are proposed for each course.

☒ **No**

- | | |
|---|--|
| <input type="checkbox"/> Alternative Perspectives A | <input type="checkbox"/> Physical Activity PE |
| <input type="checkbox"/> Art, Music, Theatre AR | <input type="checkbox"/> Philosophy PH |
| <input type="checkbox"/> Cross Cultural Perspective C | <input type="checkbox"/> Religion: Christian Traditions RC |
| <input type="checkbox"/> International Honors (100-level) H1 | <input type="checkbox"/> Religion: Global Religious Traditions RG |
| <input type="checkbox"/> International Honors (200-level) H2 | <input type="checkbox"/> Science and Scientific Method SM |
| <input type="checkbox"/> International Honors (300-level) H3 | <input type="checkbox"/> Investigating Human Behavior, Culture, and Institutions SO |
| <input type="checkbox"/> Literature LT | <input type="checkbox"/> Senior Seminar/Project SR |
| <input type="checkbox"/> Inquiry Seminar (FYEP) F | <input type="checkbox"/> Writing Seminar (FYEP) FW |
| <input type="checkbox"/> Mathematical Reasoning MR | |
| <input type="checkbox"/> Natural Sciences, Mathematics, or Computer Science NS | |

NOTE: Submissions will be forwarded to the General Education Council for its review and recommendation. Diversity courses have specific learning objectives that must be included in the syllabus.

STAFFING & BUDGETARY IMPLICATIONS

Has this proposal been formally approved by at least 2/3 of the full-time teaching faculty in your academic unit?

☒ **Yes**

☐ **No** (Indicate why the proposal is being forwarded to EPC)

Does this proposal impact any other academic unit?

☐ **Yes** (List below and indicate if 2/3 of the full-time faculty in that area support the proposal)

Mathematics

Business, Communications, Economics, Geosciences, Nursing, Political Science, Psychology and Sociology.

☐ **No**

Does this proposal require the commitment of new or substantially different support services (e.g., Library acquisitions, Information and Technology Services, Wang Center)?

☐ **Yes** (Explain and indicate if support services have been consulted)

☒ No

Explain how the proposed change(s) will be staffed. Revised 2-Year Course Cycle must be attached.

The proposed new DATA 233 was included in the most recent 2-year course cycle (attached).

Are special budgetary arrangements and funding required? If "no", explain how the proposed changes will be integrated without added personnel or budgetary requirements.

☐ Yes (Explain what types of support will be used to meet the budgetary requirements of the proposed change(s). Include the source(s) of funding, percentage of costs covered, and time frame covered.)

☒ No

Course offerings - Only one new alternate year course (DATA 233) will be added to current course offerings to support the minor. On average, the department currently offers three sections annually of two non-majors courses, CSCI 115 Solve it with the Computer and CSCI 120 Computerized Information Systems, that are not currently part of the proposed minor. Our plan is to replace one of these sections every other year with DATA 233. While these courses can count for the MR (CSCI 115) and NS (CSCI 115 & 120) general education elements, we do not anticipate that replacing one section every other year during spring or fall term will present a hardship for students. The department plans to continue to offer one section of CSCI 115 or 120 every J-term, when MR and NS general education options are more limited.

Administration - Over the past three years, the Computer Science Department has eliminated the B.S. in Computer Engineering and the Minor in Electrical Engineering. Although these programs were quite small, managing and staffing them took time. As long as the number of data science minors remains reasonable (around 25 or fewer), we believe the department has the capacity to manage the new minor without any additional staffing or reductions in teaching load.

NOTE: Budgetary considerations will be reviewed/approved by Dean and Provost.

REQUIRED SIGNATURES

Laurie Murphy 11/1/2018
Department Chair/Program Chair/Associate Dean (Date)

Ann J. Arnes 11/1/2018
Dean (Date)

Jan Dry 11/14/18
Provost (Date)

☒ Forwarded with Endorsement
☐ Forwarded with Reservations



Memorandum Office of the Registrar

To: Dr. Gregson, Provost

From: Kelly Gaspar Poth, Associate Registrar, x7139, gasparka@plu.edu

Date: November 9, 2018

Re: Creation of DATA Minor, DATA 133, 233 (Type 1, 2, 3)

Requires the creation of a new minor and associated code (Data Science - NDAT), and new subject code (DATA).

MINOR IN DATA SCIENCE: PROPOSAL
OCTOBER 2018

Presented by:

Ann Auman, Dean, Division of Natural Sciences (aumanaj@plu.edu)

Laurie Murphy, Chair, Computer Science Department (lmurphy@plu.edu)

Renzhi Cao, Assistant Professor, Computer Science (caora@plu.edu)

Nicola Justice, Assistant Professor, Mathematics Department (njustice@plu.edu)

Rationale

"Data science is emerging as a field that is revolutionizing science and industries alike. Work across nearly all domains is becoming more data driven, affecting both the jobs that are available and the skills that are required. As more data and ways of analyzing them become available, more aspects of the economy, society, and daily life will become dependent on data."

National Academy of Sciences (NAS), 2018

Societal Demands:

Our society increasingly values decisions that are supported by data. PLU graduates who can enter their vocations and their communities with experience of collecting, managing, and analyzing data will be empowered to lead and serve more thoughtfully, skillfully, and rationally.

The data science minor would largely improve PLU students' data related skills and help them to stand out in a competitive job market. In a recent report of the top ten hard skills companies need most¹, two are central to the proposed minor: #2 - Statistical Analysis and Data Mining and #7 - Data Presentation.

Current Offerings at PLU:

While the current statistics and computer science minors are each valuable in their own rights, there is a need for a minor that will prepare students simultaneously to analyze and manage data. The proposed data science minor, housed in the Computer Science Department, bridges across both disciplines, providing students the opportunity to develop basic skills needed to effectively and ethically collect, manage, and analyze data. The minor also gives students the option to either use the data-handling skills in a specific area of interest in an applied course, or to deepen their understanding of CS skills with an additional data-oriented CSCI course.

¹ from LinkedIn

https://www.linkedin.com/pulse/skills-companies-need-most-2018-courses-get-them-paul-petron/e/?trk=li_corpblog_jobs_skills_2018

Offerings at Peer Institutions:

Locally, there does not appear to be a data science minor offered nearby, although statistics and computer science minors are present. The University of Puget Sound offers mathematics and computer science minors, but there is no mention of either a statistics or a data science minor. At UW Tacoma, for example, there is no data science minor although they offer graduate programs in data analytics. Majors in data science are offered by several institutions across the nation, including Luther College (IA), Valparaiso University (IL), and Smith College (MA).

Student Interest:

In 2014, The PLU Office of Assessment, Accreditation, and Research, administered a survey of Natural Sciences students under the approval of NSCI Dean Matthew Smith. The results (n=291; 52 % response rate) indicate that over 60% of respondents perceived moderate to strong interest in a data science minor. PLU student Matthew Conover (currently a summer intern at T-mobile) said:

"Data science is an important bridge between CS and real world applications. It's very important in our current time of big data. I think a minor in data science would be helpful for all students in CS who are going to be working with backend systems or research."

When he learned of the potential for a minor to be offered at PLU, economics and computer science student Max Staple said:

"...I recognize the value a data science minor offers to students. This minor would allow me to gain an introduction to the tools and skill sets that are in high demand today, and this minor would serve as a credible signal to employers that I have gained this experience. I am hopeful that I might have an opportunity to participate."

Based on the summer intern experience at Fred Hutchinson Cancer Research Center, PLU student John Smith said:

"Data science allows for collaboration between many different fields. Much of the work I am doing involves interacting with specialists in math, physics and biology. Handling and analyzing the data their experiments have generated is critical in getting the most out of those experiments and would not be possible without data science."

Overview

Target Audience:

Students who would benefit from in-depth experiences managing, analyzing, and visualizing data. The minor is designed for students from virtually any major, although quantitative literacy at or exceeding the level of PLU MATH 140 (Precalculus) is required.

Primary Student Learning Outcomes (some adapted from NAS, 2018):

- Students will gain experience making non-trivial decisions about data management, data collection, and data analysis (e.g., how to handle missing data; how to discern outliers as candidates for omission), including ethical reporting, presentation and justification of these decisions, and an understanding how their consequences may wildly affect resultant conclusions and decisions.
- Students will become capable in organizing and curating data (e.g., storing and accessing data in databases; cleaning data to prepare for analysis, protecting confidential data).
- Students will learn multiple methods of data analysis and modeling techniques, knowledge of when each may be appropriate (e.g., statistical inference, cross-validation techniques, machine learning), and an understanding of the limitations of conclusions according to each (e.g., shortcomings of p-values; the effect of sample size; lack of data and dirty data; problems with overfitting).
- Students will communicate results of analysis (e.g., visualization techniques, verbal and oral presentation, addressing ethical considerations).
- Students will apply knowledge they learned in the data science minor to solve problems and answer data-related questions in their respective fields of study.

Expected Enrollment / Current Capacity:

25 students per every two years.

We estimate this capacity will be nearly reached because previous survey data suggest that 150 students in the Natural Sciences Division had moderate-to-strong interest in a data science minor. We don't expect all 150 students to declare the minor; however, we expect participation from about 15-20 Natural Sciences students every two years. Meanwhile, we expect 5-10 students from other majors across campus to participate, based on data suggesting the *Introduction to Computational and Data Science* course served students in many other majors across campus².

² In two offerings of CSCI 133 *Introduction to Computational and Data Sciences* in Spring 2016 and Spring 2017 the course was taken by 33 students from 10 majors (Biology, Business Administration, Chemistry, Computer Science, Economics, Engineering 3-2, Mathematics, Physics, Politics & Government, Psychology and Undeclared).

Credits Required:

20 credits (8 of which may be double-counted for other major or minor requirements)

Prerequisite Requirements:

Math 140-Precalculus or equivalent

Additional prerequisites for domain-specific courses may apply (see below)

Structure: 5 courses (20 credits)

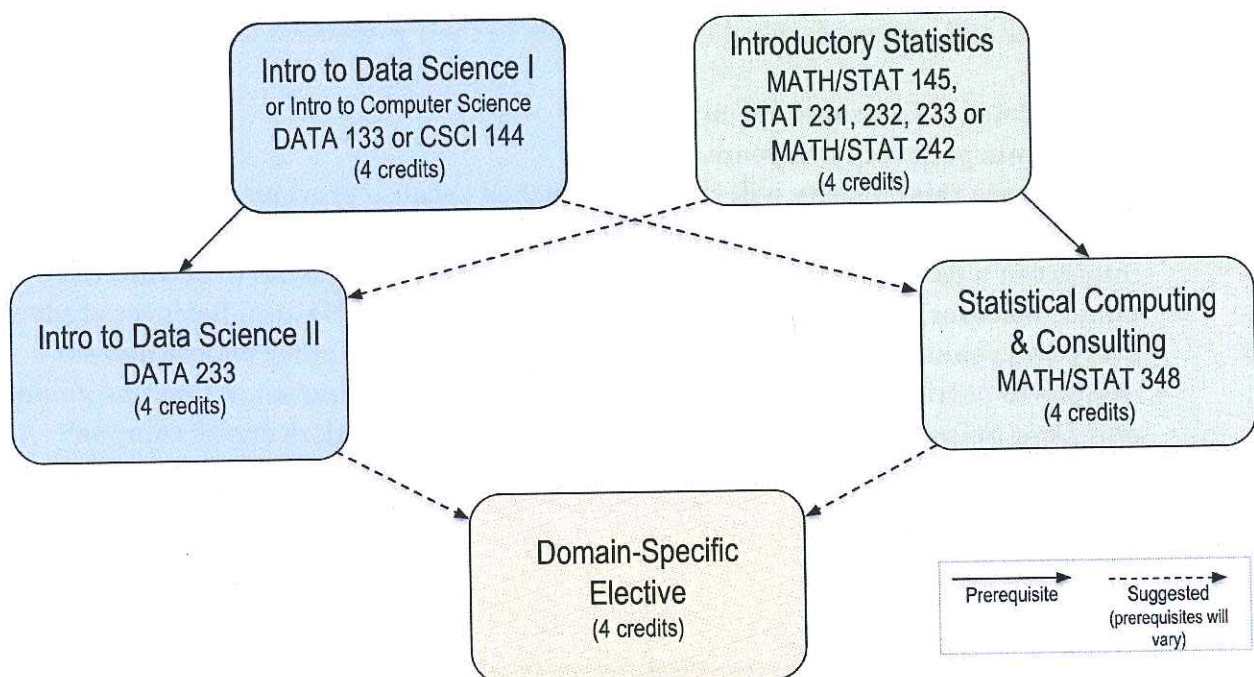
The proposed structure is guided by consensus documents among professional organizations that articulate complementary roles of statistical and computational methods in data science, and the value of integrating these in a domain-specific context.

“Breiman (2001) spoke of the two cultures of algorithmic (computational) and data (statistical) models... Data science offers the opportunity to integrate and use both... to solve problems rather than emphasizing one over the other.” De Veaux et al. (2017)

“Reinforcing skills and capacities developed in data science courses in the context of a specific domain will help students see the entire data science process...” □ NAS, (2018)

Minor in Data Science

(20 credits)



Computational and Data Science Foundations - 8 semester hours

- DATA 133 Introduction to Data Science I or CSCI 144 Introduction to Computer Science (4)
- DATA 233 Introduction to Data Science II (4)

Statistical Foundations - 8 semester hours

- Any of MATH/STAT 145, STAT 231, 232, 233, or MATH/STAT 242 (4)
- MATH/STAT 348 Statistical Computing and Consulting (4)

Domain-Specific Elective - 4 semester hours

- BUSA 310: Information Systems and Database Management (4)
- BUSA 467: Marketing Research (4)
- COMA 342 : Applied Research (4)
- CSCI 330: Artificial Intelligence (4)
- CSCI 367: Databases and Web Programming (4)
- ECON 344: Econometrics (4)
- GEOS 331: Maps: Computer-Aided Mapping and Analysis (4)
- NURS 360: Nursing Research and Informatics (4)
- POLS 301: Political Science Methods (4)
- PSYC 242: Advanced Statistics and Research Design (4)
- SOCI 232: Research Methods (4)

DATA prefix:

The minor includes two courses with "DATA" as the prefix. The rationale for this prefix is to distinguish data science classes from computer science classes, and to highlight the minor and those classes on a separate catalog page. The DATA prefix also gives B.S. CS students a pathway to complete the minor without violating the 44-hour rule. Note that B.S. CS students are required to take MATH 242 for their major and even with the DATA prefix may only count one CSCI course (either CSCI 144 or the domain-specific elective) toward both the major and minor due to the 8-credit overlap limit. The presumption is that, along with the minor, the DATA prefix will be housed in Computer Science.

Program Cost

The minor is largely made up of existing courses that can accommodate the projected number of students. The presumption is that the majority of students who pursue the minor will take statistics and a domain specific course as requirements for their major or another minor. DATA 133 (now CSCI 133) is currently offered annually in the spring with a capacity of 25 students as part of the CS department's regular teaching load. The newly revised MATH 348 course is also scheduled to be offered in alternating years by the Math Department, and no additional course offerings are expected to be needed at this time. DATA 233 is the only brand new course for the minor and we expect it can be offered in alternating years as a replacement for one of the CS department's current non-major/general education offerings. We do not foresee any additional costs for the minor unless it becomes so popular that new sections of required courses must be added to the schedule.

References

Breiman, L. (2001). Statistical modeling: The two cultures. *Statistical Science*, 16(3), 199-231.

De Veaux, R. D., Agarwal, M., Averett, M., Baumer, B. S., Bray, A., Bressoud, T. C., Bryant, L., Cheng, L. Z., Francis, A., Gould, R., Kim, A. Y., Kretchmar, M., Lu, Q., Moskol, A., Nolan, D., Pelayo, R., Raleigh, S., Sethi, R. J., Sondjaja, M., Tiruviluamala, N., Uhlig, P. X., Washington, T. M., Wesley, C. L., White, D., & Ye, P. (2017). Curriculum guidelines for undergraduate programs in data science. *Annual Review of Statistics and Its Application*, 4, 15-30.

National Academy of Sciences (NAS). (2018). *Data Science for Undergraduates: Opportunities and Options. A Consensus Study Report of the National Academies of Sciences, Engineering, and Medicine*. Washington, DC: National Academies Press. Retrieved from: <https://www.nap.edu/catalog/25104/data-science-for-undergraduates-opportunities-and-options>

Data Science

Our society increasingly values decisions that are supported by data. PLU graduates who can enter their vocations and their communities with experience of collecting, managing and analyzing data will be empowered to lead and serve more thoughtfully, skillfully, and rationally.

Data science is emerging as a field that is revolutionizing science and industries alike. Work across nearly all domains is becoming more data driven, affecting both the jobs that are available and the skills that are required. As more data and ways of analyzing them become available, more aspects of the economy, society, and daily life will become dependent on data.... Data science spans a broader array of activities that involve applying principles for data collection, storage, integration, analysis, inference, communication, and ethics. — National Academy of Sciences (NAS), 2018

The Data Science Minor is ideal for students who would benefit from in-depth experiences managing, analyzing, and visualizing data. The minor is designed for students from virtually any major, although quantitative literacy at or exceeding the level of PLU MATH 140 (Precalculus) is required.

Minor

20 semester hours

Data Science minors must complete a minimum of 20 credit hours in the following areas:

- Computational and Data Science Foundations (8)
- Statistical Foundations (8)
- Domain-Specific Elective (4)

Students may complete requirements for the minor in any order that meets course prerequisites.

A maximum of eight (8) credits may be double-counted for other major and minor requirements, although students minoring in statistics may not use any of their "8 additional semester hours of statistics" toward the data science minor.

Students may transfer in a maximum of 8 semester hours towards the Data Science minor, unless they have permission from the chair.

All courses counted towards the minor must be completed with grades of C or higher.

Program Requirements

Computational and Data Science Foundations

8 semester hours

- DATA 133: Introduction to Data Science I or CSCI 144: Introduction to Computer Science (4)
- DATA 233: Introduction to Data Science II (4)

Statistical Foundations

8 semester hours

- Any of MATH/STAT 145, STAT 231, 232, 233, or MATH/STAT 242 (4)
- MATH/STAT 348: Statistical Computing and Consulting (4)

Domain-Specific Elective

4 semester hours

Select at least one course from the list of electives below that applies data science principles in a disciplinary context or provides deeper study of data science topics. The course must go beyond introductory topics and techniques to develop advanced statistical expertise for the respective field where at least one of the following are met:

- 1) data are not easily collected (e.g., makes use of intricate study design; requires in-depth survey design), OR
- 2) data are not easily managed (e.g., data are messy; data set is excessively large; data are not easily synthesized), OR
- 3) data are not easily analyzed by selecting routine analyses from a series of menu items (e.g., arguments must be made for appropriate covariates), OR
- 4) data are not easily presented (e.g., requires sophisticated visualization techniques)

Approved courses include:

- BUSA 310: Information Systems and Database Management (4)
- BUSA 467: Marketing Research (4)
- COMA 342: Applied Research (4)
- CSCI 330: Artificial Intelligence (4)
- CSCI 367: Databases and Web Programming (4)
- ECON 344: Econometrics (4)
- GEOS 331: Maps: Computer-Aided Mapping and Analysis (4)
- NURS 360: Nursing Research and Informatics (4)
- POLS 301: Political Science Methods (4)
- PSYC 242: Advanced Statistics and Research Design (4)
- SOCI 232: Research Methods (4)

Data Science [DATA] - Undergraduate Courses

DATA 133: Introduction to Data Science I

Introduction to computer programming and problem-solving using real datasets from a variety of domains such as science, business, and the humanities. Introduces the basics of data science concepts through computational thinking, modeling and simulation and data visualization using the Python programming language and R statistical software. Intended for students without prior programming experience. Prerequisite: Completion of PLU MATH 140 or an equivalent college-level course with a grade of C or better; or PLU mathematics placement into PLU MATH 151 or a higher numbered PLU mathematics course. (4)

DATA 233: Introduction to Data Science II

Continuation of DATA 133, topics may include data manipulation, cleaning and visualization techniques, machine learning techniques, natural language processing, databases, text mining, data science ethics/privacy, etc. Students will collaborate with help of version control systems like GitHub. Python is the main programming language used. Prerequisite: DATA 133 or CSCI 144. Recommended: One of MATH/STAT 145, STAT 231, 232, 233, or MATH/STAT 242. (4)

DATA 233: Introduction to Data Science II Syllabus (Draft)

Course Description

Continuation of DATA 133, topics may include data manipulation, cleaning and visualization techniques, machine learning techniques, natural language processing, databases, text mining, data science ethics/privacy, etc. Students will collaborate with help of version control systems like GitHub. Python is the main programming language used. **Prerequisite:** DATA 133 or CSCI 144. Recommended: One of MATH/STAT 145, STAT 231, 232, 233, or MATH/STAT 242. (4)

Course Goals

- Developing Python programming skills.
- Developing problem solving and critical thinking skills by solving data related problems in different fields.
- Developing hands-on skills in data analysis, information visualization and machine learning.
- Inspiring students' interest in data science and developing skills that will allow students to explore other fields.

Learning Objectives

- Learn to obtain, manage, and restructure data provided in different forms.
- Learn hands-on skills in data mining and machine learning techniques, and be able to build machine learning models.
- Understand issues surrounding data science ethics/privacy.
- Work with data in different domains, such as business, bioinformatics, etc.
- Develop skills to work on interdisciplinary projects.
- Develop teamwork skills using tools like Github.
- Learn hands-on skills to write SQL for storing, manipulating and retrieving complex or large datasets.
- Visualize complex datasets.

Suggested Textbook

Data Science from Scratch - First Principles with Python. O'Reilly Media, 2015.

Topics

- Introduction to Python and comparison with JAVA programming
- Getting data from different sources with Python
- Data Cleaning and manipulating with Python
- Machine learning and k-Nearest Neighbor in Python
- Naïve Bayes and linear regression
- Multiple/logistic regression
- Guest lecture for applications of data science in fields like Business, Biology, etc.

- Decision tree and neural networks
- Natural Language Processing and network analysis
- Database and SQL
- Big data and association mining
- Data science ethics/privacy
- Data science on social networks, text mining

Assignments

- Example Programming Assignments
 - Protein sequence and structure analysis
 - Store and process big data in database using SQL
 - Social network data analysis
 - Train machine learning model to make predictions on finance data
- Midterm (one or two exams) and Final Exam
- Homework, readings, and in-class exercises

Educational Policies Committee

Data Science Minor: Type 3 Curriculum Change

[illegible]

2019-2020 Academic Year

Course	Course Title	# Fall Sections	# J-Term Sections	# Spring Sections	Total # Sections	Multi-Disciplinary Program Related [please specify which program(s)]	Comments
CSCI 115	Solve It With Computers MR,NS	1	1	0	2		
CSCI 120	Computerized Info Systems NS	0	0	1	1		
CSCI 131	Intro to Engineering NS	0	0	1	1		
CSCI 131 LAB	Intro to Engineering NS Lab	0	0	2	2		
DATA 133	Introduction to Data Science I	1	0	0	1		Prefix and course name change require EPC approval
CSCI 144	Intro to Computer Science NS	3	0	2	5		
CSCI 144 LAB	Intro to Computer Science NS Lab	3	0	2	5		Have increased seats per section and reduced fall lab sections by one.
CSCI 190	FYEP SEMINAR	0	0	0	0	FYEP	
CSCI 270	Data Structures	1	0	2	3		
CSCI 270 LAB	Data Structures Lab	2	0	2	4		
CSCI 287	Special Topics in CSCI	0	0	0	0		
CSCI 288	Special Topics in CSCI	0	0	0	0		
CSCI 289	Special Topics in CSCI	0	0	0	0		
CSCI 302	Computer Organization	1	0	1	2		
CSCI 302 LAB	Computer Organization Lab	1	0	1	2		
CSCI 330	Artificial Intelligence	0	0	0	0		This is now an alternating year course
CSCI 331	Electrical Circuits	0	0	0	0		This is now an alternating year course
CSCI 331 LAB	Electrical Circuits Lab	0	0	0	0		This is now an alternating year course
CSCI 340	Formal Languages	0	0	0	0		Also alternating year course
CSCI 343	Programming Lang Concepts	1	0	1	2		
CSCI 345	Microelectronics	0	0	0	0		Unlikely to be offered again due to removal of CE & EE minor, although it depends on TT hiring
CSCI 345 LAB	Microelectronics Lab	0	0	0	0		Unlikely to be offered again due to removal of CE & EE minor, although it depends on TT hiring
CSCI 367	Database and Web Programming	0	0	1	1		
CSCI 371	Design/Analysis/Algorithms	1	0	0	1		
CSCI 386	Computer Networks	1	0	0	1		

2