ARIZONA BOARD OF REGENTS
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Request to Establish New Academic Program in Arizona

Please complete all fields. Boxes may be expanded to accommodate longer responses. Clarifying field descriptions can be found below.

University: University of Arizona

Name of Proposed Academic Program: Master of Science in Data Science & Applied Statistics
Academic Department: Department of Mathematics (College of Science)
Geographic Location: Tucson - Main
Instructional Modality: In-person
Total Credit Hours: 30
Proposed Inception Term: Fall 2023
Brief Program Description: The College of Science will establish and host a new interdisciplinary Professional Master's Program in Data Science and Applied Statistics. This degree is designed to target working professionals with strong technical backgrounds who seek to add advanced statistical and data science theory and tools to their arsenal. The interdisciplinary nature of the degree makes it accessible and attractive to prospective students in virtually any industry. The program will bridge academics and industry closely, from the curriculum to experiential training to job placement. The core curriculum for the proposed degree has two 3-course sequences, balancing between the foundational theory of data science and industry application tools. The degree requires three additional courses – from an area of emphasis - earth science or computational biology – and completing a capstone experience.
Learning Outcomes and Assessment Plan:

Learning Outcome #1: Integration Integrate statistical thinking with scientific procedures and quantitative modeling and implementing these ideas using statistical software and other computational tools.
Concepts: Students will apply knowledge of probability theory and statistical methodologies to the analysis of data sets.
Competencies: Students will demonstrate this knowledge using statistical software and other computational tools to the analysis of data sets.
Assessment Methods: This outcome will be assessed in homework, exams, papers or other student projects

Measures: Instructor grading of homework, exams, papers, or other student projects based on rubrics with the learning outcomes as criteria.
Learning Outcome #2: Big Data Analysis Employ a variety of modern statistical machine learning tools, algorithms, and techniques and grasp basic concepts and skills for learning from massive and high-dimensional data to find hidden patterns and gain insights.
Concepts: Students will translate the foundational issues in machine learning and advanced algorithms to create scalable and effective learning tools.
Competencies: Students will demonstrate the ability to find latent structures lying inside massive and high-dimensional data
Assessment Methods: This outcome will be assessed in homework, exams, papers or other student projects.
Measures: Instructor grading of homework, exams, papers or other student projects based on the rubrics with the learning outcomes as criteria.
Learning Outcome #3: Data Usage. Using advanced programming skills, extract data from static and streaming sources, clean, munge, transform data for data management, storage, use and manipulation, setting effective queries to facilitate its use.
Concepts: Students will apply knowledge the theory of data management to control workflow of data from an output devise or database.
Competencies: Students will demonstrate their knowledge of data management by choosing appropriate software tools and writing effective programs to prepare data for analysis
Assessment Methods: This outcome will be assessed in homework, exams, papers or other student projects
Measures: Instructor grading of homework, exams, papers or other student projects based on rubrics with the learning outcomes as criteria.
Learning Outcome #4: Data Visualization Design a visualization so that it gives data meaning to a broader audience, highlighting special features like patterns, trends, and outliers and tying the visualization to other aspects of statistical analysis e.g., estimation, hypothesis testing, and machine learning.
Concepts: Students will effectively tie visualization to other aspects of statistical analysis e.g., estimation, classification, hypothesis testing, prediction, and learning.
Competencies: Students will have the skills to create effective visualizations and adapt the presentation to fulfill the needs of any specialize audience.
Assessment Methods: This outcome will be assessed in homework, exams, papers or other student projects.
Measures: Instructor grading of homework, exams, papers or other student projects based on rubrics with the learning outcomes as criteria.

University of Arizona AMS » Sandboxes
Ingrid Novodvorsky Playspace

PSM Data Science & Applied Statistics

Courses and Activities Mapped to PSM Data Science & Applied Statistics

	Outcome							
	Core Outcome 1: Integration Integrate statistical thinking with scientific procedures and quantitative modeling and implement these ideas using statistical software and other computational tools.	Core Outcome 2: Big Data Analysis Employ a variety of modern statistical machine learning tools, algorithms, and techniques and grasp basic concepts and skills for learning from massive and high-dimensional data to find hidden patterns and gain insights.	Core Outcome 3: Data Usage Using advanced programming skills, extract data from static and streaming sources, clean, munge, transform data for data management, storage, use, and manipulation, setting effective queries to facilitate its use.	Core Outcome 4: Data Visualization Design a visualization so that it gives data meaning to a broader audience, highlighting special features like patterns, trends and outliers, adapting and refining the visualization to emphasize various aspects of the data, and tying the visualization to other aspects of statistical analysis e.g., estimation, hypothesis testing, and machine learning.	Comp. Bio. Outcome 1: Evaluation of Analysis Approaches Students will be able to evaluate the suitability of various analysis approaches for different biological questions and data.	Comp. Bio. Outcome 2: Evaluation of Literature Analyses Students will be able to evaluate the use of computational analyses in the scientific literature.	Earth Science Outcome 1: Earth Science Data Analysis Students will be able to analyze and digest large earth science data sets.	Earth Science Outcome 2: Data Visualization Students will be able to visualize and analyze large data sets using machine learning and other computational tools.
Theoretical Foundations								
MATH 509D Statistics for Data Science	I	I	I	I				
STAT 675 Statistical Computing	P							
MATH 574M Statistical Machine Learning	A	A						
Application Tools								
CSC 501 Advanced Programming		I						
BIOS 576E Data Management		P	P					
CSC 544 Advanced Data Visualization				P				
Computational Biology Emphasis								
MCB 516 Bioinformatics & Functional Genomic Analysis					P/A	I		
MCB 547 Big Data in Molecular Biology and Biomedicine					P/A	I/P		
MCB 580 Introduction to Systems Biology					P/A			
Earth Science Emphasis								
HWRS 5XX Earth Infomatics							I	I

Assessment Measure	Source(s) of Evidence	Data Collection Point(s)
Job Placement Statistics	Student/Alumni Survey	At graduation and as part of alumni survey
Academic Program Review	Reviewers' responses	Every 7 years
Exit Interviews	Recent graduates	At graduation
Program Interest	Number of qualified applicants	Every year

Projected Enrollment for the First Three Years:

Year 1 – 15
Year 2 – 25
Year 3 – 25

Evidence of Market Demand:

A combined Burning Glass analysis for Data Science, General (30.7001), Applied Statistics, General (27.0601) shows average growth in Arizona and high growth nationally. The growth of statistician positions over the next eight years (projected at 31% for 2018-2028 by the Bureau of Labor Statistics) illustrates the potential impact on all industries. Our domain science approach is designed to target growth industries especially relevant to the state of Arizona.

Similar Programs Offered at Arizona Public Universities:

The University of Arizona is moving to have a data intensive professional master's program in several colleges - Business Analytics in the Eller College, Data Science in the College of Social

and Behavioral Sciences, and Software Engineering in the College of Engineering. Each of these programs are attractive to a distinct audience. Of the nearly one million projected new STEM jobs, approximately three-quarters will be in data science fields and over the coming decade, employers will develop an understanding of the distinctive nature of these four programs in much the same way they presently understand the difference among different degree programs in engineering or in biological sciences.

A mathematics/statistics/computer science/domain science focused professional master's degree does not yet exist at any Arizona public university. Currently, the University of Arizona has two Master's programs with "Data Science" in the title. One is in the School of Information and one is in the Graduate Interdisciplinary Program in Statistics and Data Science. The proposers of this degree are in the Statistics and Data Science GIDP.

Objection(s) Raised by Another Arizona Public University? YES NO

Has another Arizona public university lodged a written objection to the proposed program with the proposing university and the Board of Regents within seven days of receiving notice of the proposed program?

If Yes, Response to Objections:

Please provide details of how the proposing university has addressed the objection. If the objection remains unresolved, please explain why it is in the best interests of the university system and the state that the Board override it.

New Resources Required? (i.e., faculty and administrative positions; infrastructure, etc.):

a. **Summarize new resources required to offer the program:** The program as it grows will likely require additional faculty with both foundational and domain science data science expertise.
b. **Estimate total expected cost:** Six courses at steady state requires two graduate faculty members, an expense that is approximately 2 times $120K plus employment related expenses..
c. **Estimate total expected revenue of the program:** With an entering class of 25 students taking a two-year program, revenue will be ~$1,000,000 assuming an average tuition of $20,000. These numbers can become substantially larger as the program grows.

Plan to Request Program Fee/Differentiated Tuition? YES NO

Estimated Amount:

Program Fee Justification:

If planning to levy a program fee, please justify the estimated amount.

Note: The fee setting process requires additional steps, and forms need to be completed. Please work with your university and the ABOR Finance team (Leatta.McLaughlin@azregents.edu) to complete a fee request.

Specialized Accreditation? YES NO

Accreditor:

The name of the agency or entity from which accreditation will be sought