

THE UNIVERSITY OF NORTH CAROLINA ASHEVILLE

FACULTY SENATE

Senate Document Number SD2924S

Date of Senate Approval 03/07/2024

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Statement of Faculty Senate Action:

**APC 23 (MATH): Add new course MATH 295: Math for Machine Learning**

**Effective Date: Fall 2024**

**1. Add:** On page 242, new course, **MATH 295, Math for Machine Learning:**

**295 Math for Machine Learning (4)**

Introduces the essential tools of calculus, linear algebra, probability, and statistics used in machine learning. Topics include numerical differentiation and integration, optimization, linear systems, distributions, and regression. Applications in machine learning are explored. Prerequisite: MATH 191 and CSCI 182 or 183 or 185, or permission of instructor. Spring.

**Impact:** The addition of MATH 295 will have a small impact on teaching resources in the Department of Mathematics and Statistics. The Department of Computer Science is proposing to require MATH 295 for their major. There were 26 computer science graduates in 2022-2023 and 28 in 2021-2022. Offering two sections of MATH 295 each spring will be sufficient initially to serve both the data science minor and the computer science major. Computer science majors currently need to take STAT 185 or STAT 225, but this will be replaced by MATH 295. Therefore, we expect that we will offer one or two fewer sections of STAT 185 each spring. Moreover, two new faculty joined the Department of Mathematics and Statistics this year, which gives us the capacity to offer an additional course each year. We have four faculty members in the Department of Mathematics and Statistics who have expressed interest in teaching this course.

Math majors are required to take Calc I through Calc III and Linear Algebra and therefore would likely not take MATH 295. Math majors completing the minor may choose to take MATH 295, but it would not count toward the major since electives must be at the 300-400 level.

A faculty member will need to take the lead and work collaboratively with computer science to develop MATH 295. The Chair of the Department of Mathematics and Statistics will seek support through Academic Affairs and [UNC Asheville's faculty funding opportunities](#) to support these efforts.

There is no specialized space or material needs for this course. The course can be scheduled in one of the allocated classrooms for the Department of Mathematics and Statistics, which typically include RRO 210, 211, 212, and 213. The class will meet for four contact hours each week, and students will receive four credits. The instructional format will include a combination of lecture and active learning activities. The course will not be part of the UNC Common Numbering System.

### **Student Learning Outcomes**

After completing this course, students should be able to:

- Demonstrate understanding of basic mathematical concepts in machine learning, relating to calculus, linear algebra, and probability.
- Use computational tools to apply these methods in basic machine learning applications.

**Rationale:** This course is required for the proposed data science minor. Data science methods use tools from calculus, linear algebra, probability and statistics. Instead of requiring full semester courses in each of these topics, this course will provide the necessary mathematical foundation for data science students. In addition to serving the data science minor, the Department of Computer Science is proposing to add this course as a requirement for the computer science major. Computer science students are required to take a computer science course in the data science category, and MATH 295 will serve as a prerequisite for these courses. This prerequisite will alleviate the need to spend multiple classes introducing basic concepts from calculus and linear algebra in these upper level computer science courses. Moreover, this prerequisite has the potential for greater student success by providing students with a strong mathematical foundation for these upper level computer science courses. The proposed content for MATH 295 aligns with similar courses at a variety of institutions (e.g., [Math Methods for Data Science](#) at University of Michigan, [Math for Data Science](#) at UNC Chapel Hill, [Mathematics for Data Science I](#) at University of Adelaide, [Mathematics for Machine Learning and AI](#) at Sinclair Community College)