MS in Mathematical Foundation of Data Analysis

Program Description

As more and more industries see the benefit of using analytical data to improve business practices, big data and data science career opportunities are exploding. The Master of Science in Mathematical Foundations of Data Science is one of the three distinct albeit aligned interdisciplinary MS data science programs available at WSU that will equip students with the necessary expertise to meet global demand for data science professional.

The Master of Science in Mathematical Foundation of Data Analysis focuses on the mathematical foundation behind data analysis methods. This program intends produce professionals who can communicate the principles of data science statistics and analytics and assist with the design and implementation of data systems.

Earning this degree can help you gain not only in-depth mathematic and statistical understanding of data analysis methods but also a broad skill set that can be applied to a vast number of tech-related careers, such as data analysis, data engineering, data architecture professionals.

Most full-time students can complete the degree program within two years. Part-time students are also welcome.

Application

Applications for admission should be submitted to the Graduate School. Information on the application process can be found at the Graduate School:

Graduate School Application Process

Upon the request of the Dean of the Graduate School, the department then evaluates the applicant's academic record and makes a recommendation concerning admission. Final action and official notification of admission is done by the Graduate School Office.

This web site contains further program information about the MS in Mathematical Foundation in Data Analysis. For more information you may also contact the Program Director:

Dr. Tom DeLillo
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Admission Requirements

Students will be admitted to full graduate standing in the mathematical foundations of data analysis program if they have the equivalent of an undergraduate major in mathematics, have a grade point average of at least 3.000 in mathematics and

computer sciences courses, and meet Graduate School admission requirements. Students may be admitted on a conditional basis if they do not have all the prerequisite coursework.

Degree Requirements

To complete the MS in mathematical foundations of data analysis degree, students must earn 30 credit hours from the following list of courses. An oral comprehensive examination is required of all degree candidates.

	Course Name & Number	**Credit Hours**
Core Courses		
MATH 746	Introduction to Data Analytics	3
BSAN 775	Data Perspectives in Business	3
CS 746	Perspectives on Data Science	3
CS 697AB	Machine Learning	3
MATH 553	Mathematical Models	3
MATH 802	Data Analytics Capstone	3
Electives		
Statistical Electives – Choose 2		
STAT 763	Applied Regression Analysis	3
STAT 764	Analysis of Variance	3
STAT 776	Applied Statistical Methods II	3
Computing Elective – Choose 1		
STAT 774	Statistical Computing	3
MATH 751	Numerical Linear Algebra	3
CS 560	Design and Analysis of Algorithms	3
Other Elective – Choose 1		
CS 665	Introduction to Database	3
MIS 600	Database Management System	3
IME 780AN	Big Data Analytics in Engineering	3
DS 875	Advanced Business Analytics	3
	Total	**30**

Program Course

Core Courses

MATH 746 Introduction to Data Analytics (3)
Covers basic mathematical techniques for analyzing data sets. Uses object oriented programming, like Python or R, to show how to organize, visualize and analyze large data. For students to be successful in this course, basic programming knowledge is needed prior to enrolling. Prerequisite(s): MATH 511, STAT 571, or instructor's consent.

BSAN 775 Data Perspectives in Business (3)
Overview of the different perspectives of the field of analytics from math to computer science to business and more. Focuses on business analytics, starting with sources of big data, data collection and the ethical challenges associated with using data. Covers the various deterministic and prescriptive optimization models using scenarios from various business functions (operations/supply chain, finance, marketing, human resources, etc.). Students learn how to frame the problem, formulate it, solve it with Excel, then analyze and report the results. Course provides a good understanding of data analytics as applied to business, but also an appreciation for the importance of the field of data science. Prerequisite(s): familiarity with Excel.

CS 746 Perspectives on Data Science (3)
Covers the fundamentals of data science. Various introductory concepts of data science including but not limited to Data Science Process, collection/preparation of the data, preprocessing of the data, transformation of the data, exploratory data analysis, visualization, as well as introductory concepts in data mining algorithms are covered. Python language is used for the class. The class also has a student project component. Prerequisite(s): IME 254 and CS 211 or instructor’s consent.

CS 697AB Machine Learning (3)
New course.

MATH 553 Mathematical Models (3)
Covers case studies from the fields of engineering technology and the natural and social sciences. Emphasizes the mathematics involved. Each student completes a term project which is the solution of a particular problem approved by the instructor. Prerequisite(s): Math 344 with a grade point of 2.000 or better, or departmental consent.

MATH 802 Data Analytics Capstone (3)
Individual directed study in an area of data analytics appropriate for each student's career objectives. Project must be approved and guided by a member of the graduate faculty. If an internship is used in substitution for this course, it needs to be approved prior to the start date of the internship, and the project(s) must be reported to a

graduate faculty member. Prerequisite(s): Math 764 with a grade point of 3.000 or better and departmental consent.

Statistical Election – Choose 2 Courses

STAT 763 Applied Regression Analysis (3)
Studies linear, polynomial and multiple regression. Includes applications to business and economics, behavioral and biological sciences, and engineering. Uses computer packages for doing problems. Prerequisite(s): STAT 571, MATH 344 and 511 with a grade point of 2.000 or better in each, or departmental consent.

STAT 764 Analysis of Variance (3)
An introduction to experimental design and analysis of data under linear statistical models. Studies single-factor designs, factorial experiments with more than one factor, analysis of covariance, randomized block designs, nested designs, and Latin square designs. Uses computer packages for doing problems. Prerequisite(s): STAT 571, MATH 344 and 511 with a grade point of 2.000 or better in each, or departmental consent.

STAT 776 Applied Statistical Methods II (3)
Covers selected topics from multivariate analysis including statistical theory associated with the multivariate normal, Wishart and other related distributions, partial and multiple correlation, principal component analysis, factor analysis, classification and discriminant analysis, cluster analysis, James-Stein estimates, multivariate probability inequalities, majorization and Schur functions. Prerequisite(s): STAT 764 with a grade point of 2.000 or better, or departmental consent.

Computing Elective – Choose 1 Course

STAT 774 Statistical Computing (3)
Trains students to use modern statistical software for statistical modeling and writing of technical reports. Examines many of the advanced features of most commercial statistical packages. Students perform complete statistical analyses of real data sets. Prerequisite(s): STAT 763 and 764, or departmental consent.

MATH 751 Numerical Linear Algebra (3)
Includes analysis of direct and iterative methods for the solution of linear systems, linear least squares problems, Eigenvalue problems, error analysis, and reduction by orthogonal transformations. Prerequisite(s): MATH 511, 547, 551 with a grade point of 2.000 or better in each, or departmental consent.

CS 560 Design and Analysis of Algorithms (3)
Design of various algorithms including several sorting algorithms. Analysis of their space and time complexities. Data structures include heaps, hash tables and binary search trees. Prerequisite(s): CS 322, 400; STAT 460 or IME 254.

Other Elective – Choose 1 Course

CS 665 Introduction to Database (3)
Fundamental aspects of relational database systems, conceptual database design and entity-relationship modeling; the relational data model and its foundations, relational languages and SQL, functional dependencies and logical database design; views, constraints and triggers. Course includes a group project involving the design and implementation of a relational database and embedded SQL programming. Prerequisite(s): CS 311, MATH 322.

MIS 600 Database Management System (3)
Introduces various methodologies for conceptual data modeling including entity-relationship data modeling and logical database design. Covers relational database management systems, the SQL standard and data administration issues. Students obtain hands-on development with SQL servers in a client/server environment through a required database programming project. Covers topics of data warehousing, data mining, distributed database management and emerging topics in database areas. Prerequisite(s): BADM 161, 162 and 163 with a grade of C+ (2.300) or better, junior standing, advanced standing.

IME 780AN. Big Data Analytics in Engineering (3).
Provides a graduate-level introduction to methods in data science and big data analytics with engineering applications. Specifically, examines some widely used statistical methods and machine learning tools for big data (data with high volume, velocity and variety). A variety of up-to-date industrial engineering topics are covered as application examples. Prerequisite(s): basic engineering statistics and programming skills.

DS 875 Advanced Business Analytics (3)
Overview of analytical models, with a focus on probabilistic models where the decision to be made is based on uncertain events, or prior data does not exist (e.g. introducing new products to market). This introduces risk in business that needs to be measured and planned for. The models covered include decision trees, simulation, machine learning and artificial intelligence algorithms. Students learn how to use such models in business, and not how to program the code behind the algorithm. Students mainly use Excel, advanced add-ins to Excel (Palisade), and freely available open source algorithms coded in Python. Students also use advanced visualization software like PowerBI Desktop to prepare, connect, analyze and visualize data from multiple sources. Prior enrollment in DS 675/FIN 675 is recommended, but not required. Prerequisite(s): Familiarity with Excel, instructor's consent; BSAN 775 or equivalent is highly recommended.