

THE FIELD

Mathematics is the language of the sciences, providing a bridge between experimental observation and scientific theory. Modern mathematics encompasses a wide variety of fields, from the formulation of mathematical models of complicated physical and biological systems to the study of abstract algebraic and geometric objects. As technology improves, it becomes more reliant on mathematics, while simultaneously driving mathematics forward. Modern algebra is closely connected to theoretical physics; number theory is increasingly applied to computer and communications security; geometry and analysis are applied to many problems of science and engineering; and ordinary, partial, and stochastic differential equations are important in physics, finance, and engineering research. Applications of mathematics include aircraft design, properties of materials, cryptography, understanding the spread of disease, oil well simulation, image processing, financial derivatives, and genomics.

The last decade has seen an explosion in the quantity and variety of data available about virtually everything, including pictures, stock prices, purchase patterns, medical information, and voting behavior. It is the field of statistics that manages this information, seeking understanding and knowledge through the study of data. Statistics has historically played a key role in medical research, and more generally in experimental science, by quantifying the interaction between various "causes" and "effects." However, many new and exciting applications of statistics are emerging, such as deciphering the human genome, analyzing and facilitating internet traffic, and the "mining" of very large collections of data to discern patterns and relationships. Statistics is inherently an interdisciplinary field allowing the practitioner to learn from and contribute to a wide variety of areas. This interdisciplinary nature is embodied in the burgeoning field of data science, which brings together computer scientists, statisticians, biostatisticians, and others to solve problems involving large and complex data sets.

A minor in mathematics is available. For course requirements, visit the minors and secondary majors website: math.umass.edu/undergraduate/minor.

Mathematics students may pursue secondary education certification in conjunction with the major. See the education major sheet, website, or the Guide to Undergraduate Programs for more information.

THE MAJOR

The degree requirements allow students flexibility in designing an overall course of study to meet their goals. The beginning courses emphasize computational skills, problem solving, and the understanding of basic concepts. As students progress, they must solve problems that are less routine and more abstract or intricate. Some upper-level courses emphasize proofs and the understanding of abstract structures, while others emphasize advanced computational methods or the formulation and analysis of mathematical or statistical models.

The requirements of the math major include differential and integral calculus (Math 131 and Math 132), multivariable calculus (Math 233), linear algebra (Math 235), fundamental concepts in mathematics (Math 300), computer programming (CS 121), and writing in mathematics (Math 370). Students choose a concentration in one of seven areas, which require at least eight additional courses. The concentrations are applied mathematics (preparation for careers as applied mathematicians in government, industry, or academia), actuarial science concentration (preparation for actuarial certification for the insurance industry), individually designed concentration, teaching concentration (preparation for secondary school teaching in mathematics), mathematical computing (preparation for work in the computer field or further academic study in computer science), pure mathematics (preparation for graduate study), and statistics and data science (preparation for work as statisticians or data scientists). For more details about concentrations and course requirements, visit math.umass.edu/undergraduate/departmental-graduation-requirements.

HONORS

The department offers a program in mathematics leading to higher honors at graduation. Interested students are advised to take the honors sections that are offered in the calculus and linear algebra courses. Students have the option to write an honors thesis with a faculty member. Contact the department for more information.

STUDY ABROAD

Mathematics majors may choose to study abroad. Students should contact the International Programs Office (413-545-2710; umass.edu/ipo) and work closely with the chief undergraduate advisor to choose the appropriate courses to be taken abroad. Domestic exchange is also a possibility.

CAREER OPPORTUNITIES

Abundant opportunities exist for individuals with the mathematical and statistical skills and the problem-solving ability that the major provides. In a 2015 CareerCast ranking, actuary, mathematician, and statistician placed in the top four jobs. High-technology industrial firms avidly seek graduates with knowledge of computer science, statistics, and applied areas such as differential equations and numerical analysis. Employment opportunities for mathematicians in business, industry, and government are many and varied. Mathematics majors with courses in computer science and statistics compete favorably with majors in computer science or engineering for positions in computer-related industries. For those students interested in teaching, there are many opportunities at the primary and secondary levels.

Students with a solid grasp of statistical theory and practice are valued in such areas as the pharmaceutical industry, insurance companies, governmental agencies and laboratories, and financial institutions. With the growth of statistical applications, graduates are finding work with technology companies, insurance companies, defense contractors, biotechnology firms, online retailers, data mining and statistical consulting firms, and educational testing organizations.

Students can pursue a master's degree in either applied mathematics or statistics, or a PhD in pure math, applied math, or statistics. A master of science (MS) in statistics can be earned in a fifth year. The university now offers an MS in statistics at the Mount Ida Campus in Newton, Massachusetts. Recent mathematics majors have also pursued graduate study in education, computer science, biostatistics, data science, philosophy, operations research, physics, economics, and finance, or attended professional schools in law, medicine, or business.

COLLEGE OF NATURAL SCIENCES

The College of Natural Sciences unites the life, environmental, computational, and physical sciences on campus. Students take advantage of a range of inquiry-based classroom and laboratory experiences, hands-on undergraduate research opportunities, multidisciplinary and cross-departmental education and research initiatives, and a variety of science student organizations. In addition, they are encouraged to develop strong written and oral communication skills, as well as leadership and problem-solving abilities.

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