

STATISTICS

Overview and Contact Information

Courses in the Department of Mathematics and Statistics are designed with several goals in mind: to teach the language of the mathematical sciences, to provide a command of powerful mathematical tools, to develop problem-solving skills, and to foster the ability to ask questions and make independent discoveries. Statistics courses, in addition, emphasize the interplay between applied context and mathematical models in working with numerical data.

Contact Information

Andrea Foulkes, Chair
Lindsay Woloszyn, Academic Department Coordinator

415A Clapp Laboratory
413-538-2162
<https://www.mtholyoke.edu/acad/math>

Faculty

This area of study is administered by the Department of Mathematics and Statistics:

Giuliana Davidoff, Robert L. Rooke Professor of Mathematics

Andrea Foulkes, Professor of Mathematics and Statistics

Janice Gifford, Professor of Statistics

Mark Peterson, Professor of Physics and Mathematics on the Alumnae Foundation

Margaret Robinson, Julia and Sarah Ann Adams Professor of Mathematics

Jessica Sidman, Professor of Mathematics on the John Stewart Kennedy Foundation, Teaching Spring Only

Dylan Shepardson, Associate Professor of Mathematics

Timothy Chumley, Assistant Professor of Mathematics

Alanna Hoyer-Leitzel, Assistant Professor of Mathematics

Evan Ray, Assistant Professor of Statistics

Peter Rosnick, Visiting Professor of Mathematics

Sarah-Marie Belcastro, Visiting Lecturer in Mathematics

Carrie Hosman, Visiting Lecturer in Statistics

Thomas Shelly, Visiting Lecturer in Mathematics

Jordan Tirrell, Visiting Lecturer in Mathematics

Nathan Gray, Visiting Instructor in Mathematics

Konstandinos Kotsiopoulos, Visiting Instructor in Mathematics; UMass Teaching Associate

Requirements for the Major

A minimum of 36 credits:

MATH-203 Calculus III

MATH-211	Linear Algebra	4
STAT-242	Intermediate Statistics	4
STAT-340	Applied Regression Methods	4
MATH-342	Probability	4
STAT-343	Mathematical Statistics	4
12 additional credits in mathematics or statistics at the 200-level or above ¹		12
Total Credits		36

¹ A 300-level course that contains substantial mathematical or statistical content in another discipline may be used to fulfill at most 4 credits toward the major with prior departmental approval.

Requirements for the Minor

A minimum of 16 credits:

At least one 200-level course in statistics	4
At least one 300-level course in statistics	4
Two additional courses in mathematics or statistics at the 200 level or above	8
Total Credits	16

Additional Specifications

Substitutions are possible with the permission of the department. Students planning a minor in statistics should consult one of the statistics advisors.

With departmental permission, students who have already completed one 100-level exploration course may elect to enroll in a second exploration course at the 200-level so that it may be counted toward the minor.

Course Advice

Beginning the Study of Statistics

A natural way to begin if you have not studied statistics is with STAT-140, Introduction to the Ideas and Applications of Statistics.

A 200-level course in statistics is a good choice if you have taken an advanced placement statistics course or have taken the equivalent of a 100-level statistics course.

Advice to Students with Special Interests

Actuarial science

Students interested in this area should plan to cover the material that is included in the first two actuarial exams as part of their undergraduate program. This material is included in Calculus I (MATH-101), Calculus II (MATH-102), Calculus III (MATH-203), Probability (MATH-342), and Mathematical Statistics (STAT-343), along with Macroeconomic Theory (ECON-211), Microeconomic Theory (ECON-212), and Economics of Corporate Finance (ECON-215). Students are also encouraged to obtain experience through an internship.

Biostatistics, public health, or natural resources

Students interested in these areas should include substantial work in biology, chemistry, geology, and/or environmental studies in their programs.

Economics or business

Many students with these interests choose the special major in mathematics and economics or the special major in statistics and economics.

Engineering

Students interested in engineering often double-major in mathematics and physics and/or participate in one of the College's five-year, dual-degree programs with Dartmouth's Thayer School of Engineering, or California Institute of Technology, or the University of Massachusetts (see the Other Degree and Certificate Programs chapter).

Graduate school

Students preparing for graduate school in statistics or mathematics often participate in an undergraduate research program in the summer after the junior year and continue with an honors thesis in the senior year. Students considering graduate work in statistics at the level of a Ph.D. are encouraged to include MATH-311 and especially MATH-301.

Teaching certification

Students interested in pursuing certification for middle school or secondary school should major in mathematics rather than statistics. However, there is increasing emphasis on statistics in secondary school, and any of the applied courses would provide good preparation.

Course Offerings**STAT-140 Introduction to the Ideas and Applications of Statistics**

Fall and Spring. Credits: 4

This course provides an overview of statistical methods, their conceptual underpinnings, and their use in various settings taken from current news, as well as from the physical, biological, and social sciences. Topics will include exploring distributions and relationships, planning for data production, sampling distributions, basic ideas of inference (confidence intervals and hypothesis tests), inference for distributions, and inference for relationships, including chi-square methods for two-way tables and regression.

Applies to requirement(s): Math Sciences

A. Foulkes, J. Gifford, E. Ray

Advisory: 2 years of high school algebra

STAT-240 Elementary Data Analysis and Experimental Design

Spring. Credits: 4

A fundamental fact of science is that repeated measurements exhibit variability. The course presents ways to design experiments that will reveal systematic patterns while 'controlling' the effects of variability and methods for the statistical analysis of data from well-designed experiments. Topics include completely randomized, randomized complete block, Latin Square and factorial designs, and their analysis of variance. The course emphasizes applications, with examples drawn principally from biology, psychology, and medicine.

Applies to requirement(s): Math Sciences

J. Gifford

Prereq: Any 100-level mathematics or statistics course.

STAT-241 Methods in Data Science

Fall. Credits: 4

This course introduces methods in data science, including exploring problems, developing and implementing possible data analytic solutions and interpreting findings. Statistical programming and computational reasoning are emphasized. Topics include data visualization, data manipulation, data analysis and presentation. Reproducible research methods are explored and case studies are emphasized.

Applies to requirement(s): Math Sciences

A. Foulkes

Prereq: STAT-140 and MATH-101.

STAT-242 Intermediate Statistics

Fall and Spring. Credits: 4

In this course, students will learn how to analyze data arising from a broad array of observational and experimental studies. Topics covered will include exploratory graphics, description techniques, the fitting and assessment of statistical models, hypothesis testing, and communication of results. Specific topics may include multiple regression, ANOVA, and non-linear regression. Statistical software will be used.

Applies to requirement(s): Math Sciences

C. Hosman, The department

Prereq: STAT-140 or equivalent.

STAT-295 Independent Study

Fall and Spring. Credits: 1 - 4

The department

Instructor permission required.

Advisory: The permission of the department is required for independent work to count toward the major or minor.

STAT-340 Applied Regression Methods

Fall. Credits: 4

This course includes methods for choosing, fitting, evaluating, and comparing statistical models; introduces statistical inference; and analyzes data sets taken from research projects in the natural, physical, and social sciences.

Applies to requirement(s): Math Sciences

A. Foulkes

Prereq: MATH-211 and STAT-242.

STAT-343 Mathematical Statistics

Spring. Credits: 4

This course is an introduction to the mathematical theory of statistics and to the application of that theory to the real world. Topics include probability, random variables, special distributions, introduction to estimation of parameters, and hypothesis testing.

Applies to requirement(s): Math Sciences

E. Ray

Prereq: MATH-102 and MATH-342.

STAT-344 Seminar in Statistics and Scientific Research**STAT-344BT Seminar in Statistics and Scientific Research: 'Topics in Biostatistics'**

Spring. Credits: 4

This course serves as an introduction to advanced topics in Biostatistics.

In this course, students will learn about a range of topics, including: applied Bayesian techniques, e.g. the Gibbs sampler; multiple testing adjustments for high-dimensional data; the expectation-maximization algorithm; multiple imputation for missing data; the bootstrap for hypothesis testing; and simulation techniques for characterizing algorithm performance, including power and type-1 error rates. Areas of application will include, but are not limited to, statistical genetics and genomics. This is a project-oriented course with an emphasis on statistical programming with R.

Applies to requirement(s): Math Sciences

A. Foulkes

Prereq: Any 200- or 300-level Statistics course.

STAT-395 Independent Study

Fall and Spring. Credits: 1 - 8

The department

Instructor permission required.

Advisory: The permission of the department is required for independent work to count toward the major or minor.