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

Giuliana Davidoff, Chair
Sheila Heady, 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, On Leave 2019-2020
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
Dylan Shepardson, Associate Professor of Mathematics
Chassidy Bozeman, Clare Boothe Luce Assistant Professorship in Mathematics
Timothy Chumley, Assistant Professor of Mathematics, On Leave 2019-2020
Alanna Hoyer-Leitzel, Kennedy-Schelkunoff Assistant Professor of Mathematics, On Leave 2019-2020
Lidia Mrad, Assistant Professor of Mathematics
Marie Ozanne, Clare Boothe Luce Assistant Professorship in Statistics
Peter Rosnick, Visiting Professor of Mathematics
Nathan Gray, Visiting Lecturer in Mathematics
Thomas McAndrew, Visiting Lecturer in Statistics
Amy Nussbaum, Visiting Lecturer in Statistics
Rebecca Tramel, Visiting Lecturer in Mathematics
Ashley Wheeler, Visiting Lecturer in Mathematics

Requirements for the Major

A minimum of 36 credits:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MATH-101</td>
<td>Calculus I</td>
<td></td>
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<tr>
<td>MATH-102</td>
<td>Calculus II</td>
<td></td>
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<tr>
<td>MATH-203</td>
<td>Calculus III</td>
<td></td>
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<tr>
<td>MATH-211</td>
<td>Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>STAT-140</td>
<td>Introduction to the Ideas and Applications of Statistics</td>
<td></td>
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<tr>
<td>STAT-242</td>
<td>Intermediate Statistics</td>
<td></td>
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<tr>
<td>STAT-340</td>
<td>Applied Regression Methods</td>
<td></td>
</tr>
<tr>
<td>MATH-342</td>
<td>Probability</td>
<td></td>
</tr>
<tr>
<td>STAT-343</td>
<td>Mathematical Statistics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12 additional credits in mathematics or statistics at the 200-level or above</td>
<td>12</td>
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</tbody>
</table>

Total Credits 36

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:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>At least one 200-level course in statistics</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>At least one 300-level course in statistics</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Two additional courses in mathematics or statistics at the 200 level or above</td>
<td>8</td>
</tr>
</tbody>
</table>

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.
Advisory: 2 years of high school algebra

A. Nussbaum, M. Ozanne, R. Tramel, The department

Applies to requirement(s): Math Sciences

regression.

for relationships, including chi-square methods for two-way tables and

intervals and hypothesis tests), inference for distributions, and inference

production, sampling distributions, basic ideas of inference (confidence

underpinnings, and their use in various settings taken from current news,

experiments. Topics include completely randomized, randomized

completely block, Latin Square and factorial designs, and their analysis

of variance. The course emphasizes applications, with examples drawn

principal from biology, psychology, and medicine.

Applies to requirement(s): Math Sciences

The department

Prereq: Any 100-level mathematics or statistics course.

STAT-240 Intermediate Data Analysis and Experimental Design

Not Scheduled for This Year. 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

The department

Prereq: Any 100-level mathematics or statistics course.

STAT-241 Methods in Data Science

Not Scheduled for This Year. 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

The department

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

M. Ozanne, E. Ray

Prereq: STAT-140 or equivalent.

STAT-242NP Intermediate Topics in Statistics: 'Nonparametric Statistics'

Not Scheduled for This Year. Credits: 4

The methods taught in traditional statistics courses are based on

assumptions that are often not satisfied by real data sets. In this course

we will learn about approaches that require fewer assumptions, known

as nonparametric methods. After taking this course, students will be

able to examine assumptions for different approaches to statistical

inference, compare nonparametric statistical tests such as sign and

Wilcoxon tests to their parametric equivalents, and implement non-

parametric approaches using R. In addition, the course will incorporate

computational techniques for statistical analysis, including simulation,

permutation tests, and bootstrapping.

Applies to requirement(s): Math Sciences

A. Nussbaum

Prereq: STAT-140.

Advisory: Students should have experience with the programming language

R.
STAT-244 Intermediate Topics in Statistics

STAT-244NP Intermediate Topics in Statistics: 'Nonparametric Statistics'
Spring. Credits: 4
The methods taught in traditional statistics courses are based on assumptions that are often not satisfied by real data sets. In this course we will learn about approaches that require fewer assumptions, known as nonparametric methods. After taking this course, students will be able to examine assumptions for different approaches to statistical inference, compare nonparametric statistical tests such as sign and Wilcoxon tests to their parametric equivalents, and implement non-parametric approaches using R. In addition, the course will incorporate computational techniques for statistical analysis, including simulation, permutation tests, and bootstrapping.
Applies to requirement(s): Math Sciences
A. Nussbaum
Prereq: STAT-140.
Advisory: Students should have experience with the programming language R.

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
T. McAndrew, E. Ray
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, The department
Prereq: MATH-102 and MATH-342.

STAT-344 Seminar in Statistics and Scientific Research

STAT-344NE Seminar in Statistics and Scientific Research: 'Introduction to Neural Networks'
Spring. Credits: 4
Neural networks are some of the most commonly used models in statistical and machine learning. They have been employed in applications ranging from image classification to time series prediction. In this course we will develop neural networks as statistical models that are closely related to multiple regression and logistic regression, and we will use tools from calculus and linear algebra to understand algorithms for parameter estimation. In applications, we will work with the Keras library in Python.
Applies to requirement(s): Math Sciences
E. Ray
Prereq: MATH-203, MATH-211, and STAT-242.
Advisory: Basic familiarity with programming in Python or willingness to learn independently.

STAT-344SM Seminar in Statistics and Scientific Research: 'Survey Sampling'
Not Scheduled for This Year. Credits: 4
In this course, students will explore statistical techniques for designing and analyzing complex survey designs. Sample surveys are used to obtain data on demography, health, and development; to measure attitudes and beliefs; to estimate natural resources; to evaluate the impact of social programs; along with many other uses. The proper design and analysis of these surveys is crucial to their utility. We will cover topics including survey design, ratio estimation, regression estimation, poststratification, imputation, and survey error. We will also make frequent use of real (and often messy) survey data through assignments and projects. Background should include hypothesis testing, regression modeling, and estimation.
Applies to requirement(s): Math Sciences
C. Hosman
Prereq: STAT-340.

STAT-344SP Seminar in Statistics and Scientific Research: 'Stochastic Processes'
Not Scheduled for This Year. Credits: 4
A stochastic process is a collection of random variables. For example, the daily prices of a particular stock are a stochastic process. Topics of this course will include Markov chains, queueing theory, the Poisson process, and Brownian motion. In addition to theory, the course will investigate applications of stochastic processes, including models of call centers and models of stock prices. Simulations of stochastic processes will also be used to compare with the theory.
Crosslisted as: MATH-339SP
Applies to requirement(s): Math Sciences
T. Chumley
Prereq: MATH-211 and MATH-342.

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.