

Statistics

The statistics major and minor are administered by the Department of Mathematics and Statistics and taught by the faculty of that department. Advisors: Professor Gifford (*chair*); Assistant Professor Kim.

Contact Persons

Laurie Kamins, senior administrative assistant

Janice Gifford, *chair*

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.

Requirements for the Major

Credits

- A minimum of 32 credits
- 20 credits at the 300 level

Courses

- Mathematics:
 - 203, Calculus III
 - 211, Linear Algebra
- At least two courses selected from the applied statistics courses:
 - 240, Elementary Data Analysis and Experimental Design
 - 340, Applied Regression Methods
 - 344, Seminar in Statistics and Scientific Research
- At least two courses selected from the more mathematical statistics courses:
 - 341, Linear Statistical Models
 - 342, Probability
 - 343, Mathematical Statistics

Additional courses may be taken from 300-level mathematics or statistics courses.

Requirements for the Minor

Credits

- A minimum of 16 credits in mathematics or statistics at the 200 level or above

Courses

- Statistics 240, Elementary Data Analysis and Experimental Design
- At least one of the following statistics courses:
 - 340, Applied Regression Methods
 - 341, Linear Statistical Models
 - 343, Mathematical Statistics
 - 344, Seminar in Statistics and Scientific Research

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

Beginning the Study of Statistics

A natural way to begin if you have not studied statistics is with Statistics 140, Introduction to Statistics.

Statistics 240, Data Analysis and Experimental Design is a good choice if you have taken an advanced placement statistics course or have taken the equivalent of a 100-level mathematics or statistics course and you want to learn about designing and analyzing experiments in biology, psychology, and medicine.

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 (Mathematics 101), Calculus II (Mathematics 202),

Calculus III (Mathematics 203), Probability (Statistics 342), and Mathematical Statistics (Statistics 343), along with Macroeconomic Theory (Economics 211), Microeconomic Theory (Economics 212), and Economics of Corporate Finance (Economics 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 Mathematics 311, Algebra I and especially Mathematics 301, Real Analysis in their program of study.

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

140fs Introduction to the Ideas and Applications of Statistics

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.
Meets Science and Math II-A requirement
J. Kim, J. Gifford, The department
Prereq. 2 years of high school algebra; 4 credits

240fs Elementary Data Analysis and Experimental Design

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.
Meets Science and Math II-A requirement
J. Gifford
Prereq. Any 100-level mathematics or statistics course or permission of instructor.; 4 credits

295fs Independent Study

Does not meet a distribution requirement
The department
Prereq. soph, permission of department; 1-4 credits

340f Applied Regression Methods

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.
Meets Science and Math II-A requirement
J. Kim
Prereq. Mathematics 211 or any statistics course; 4 credits

341s Linear Statistical Models

Mathematical concepts from linear algebra and n-dimensional Euclidean geometry, together with statistical concepts of estimation

and hypothesis testing, are developed and used to construct a unifying theory for two classes of applied methods: analysis of variance and regression analysis. The theory is developed in three stages: least squares and orthogonal projections; moment assumptions and the Gauss-Markov theorem; and the normal distribution and F-tests.

*Meets Science and Math II-A requirement
The department*

Prereq. Mathematics 211; offered alternate years, next offered spring 2014.; 4 credits

342f Probability

(Same as Mathematics 342) This course develops the ideas of probability simultaneously from experimental and theoretical perspectives. The laboratory provides a range of experiences that enhance and sharpen the theoretical approach and, moreover, allows us to observe regularities in complex phenomena and to conjecture theorems. Topics include: introductory experiments; axiomatic probability; random variables, expectation, and variance; discrete distributions; continuous distributions; stochastic processes; functions of random variables; estimation and hypothesis testing.

*Meets Science and Math II-A requirement
S. Miller*

Prereq. Mathematics 203; offered alternate years at Mount Holyoke and Smith Colleges; offered at Mount Holyoke in fall 2011 and 2013.; 4 credits

343s Mathematical Statistics

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.

*Meets Science and Math II-A requirement
The department*

Prereq. Mathematics 202 and 342; offered every spring semester alternately at Mount Holyoke and Smith Colleges; offered at Mount Holyoke in spring 2014.; 4 credits

***344s Seminar in Statistics and Scientific Research: Categorical Data Analysis**

In this course students will learn about statistical methods for analyzing categorical data. Chi-square tests, measures of association, lo-

gistic regression, and loglinear modeling techniques. Background should include estimation, hypothesis test, regression modeling, and the analysis of variance.

*Meets Science and Math II-A requirement
The department*

Prereq. Statistics 240 or 340, or permission of instructor; offered alternate years; next offered in the spring 2013; 4 credits

395fs Independent Study

*Does not meet a distribution requirement
The department*

Prereq. jr, sr, permission of department; 1-8 credits