MAJOR IN STATISTICS

The major in Statistics is designed to meet three goals: to introduce some of the central ideas of information and data science, to develop problem-solving ability by teaching students to combine creative thinking with rigorous reasoning, and to develop interdisciplinary skills by applying statistics to an application area of interest.

REQUIREMENTS (10 courses plus colloquium)

The major in Statistics consists of ten courses plus a colloquium requirement. The major includes courses in mathematics, computer science and statistics. Students interested in continuing their study of statistics in graduate school should strongly consider taking Math 350/351 in addition to the other requirements.

Mathematics (2 courses)
MATH 150 or 151 Multivariable Calculus or equivalent high school course
MATH 250 Linear Algebra

Except in unusual circumstances, students planning to major in statistics should complete the calculus sequence (MATH 130, 140, 150/151) before the spring of the sophomore year, at the latest. MATH 150 is a prerequisite for STAT 201 and MATH 250 is a prerequisite for STAT 346.

Computer Science (1 course)
CSCI 134 Intro to Computer Science or CSCI 135 Diving into the Deluge of Data or CSCI 136 Data Structures and Advanced Programming or some other course in the Computer Science Department with prior approval of the Math/Stat department.

Core Courses (4 courses)
STAT 201 Statistics and Data Analysis, STAT 202 Introduction to Statistical Modeling or STAT 302 Applied Statistical Modeling
STAT 346 Regression and Forecasting
STAT 341 Probability
STAT 360 Inferential Statistics

Continuation (2 courses)
Any two courses among the 300 or 400 level courses in the department with a STAT prefix.

Capstone Course (1 course)
The capstone course is a 400-level STAT course taken in the senior year. Although the specific methodological emphasis of the course may vary from year to year, an in-depth project with both a written report and an oral presentation is typically part of the capstone course.

Pass/Fail policies during the Academic Year 2020-2021
Information about the Department of Mathematics and Statistics Pass/Fail policies during the Academic Year 2020-2021 can be found here.

Colloquium Requirement
Participation in the Department Colloquium, in which each senior major presents a talk on a mathematical or statistical topic of their choice. Each major must also attend at least 20 colloquia (15 during the Academic Year 2020-2021), and up to 5 attendances may be counted in their junior year. Up to 5 colloquia in mathematics or computer science may also be counted. Students engaged in study away may petition the department in advance to count up to 5 suitable colloquia attendances from their study away program.

PLACEMENT
Students with an AP Stat score of 5 or 4 are placed in the advanced introductory course Stat 202.

NOTES
Substitutions, Study Abroad, and Transfer Credit: In some cases, and with prior permission of the Mathematics and Statistics Department, appropriate courses from other institutions may be substituted for the application and continuation requirements, but at least eight courses must be taken from the Department of Mathematics and Statistics at Williams.

These can, with prior permission, include courses taken away. Students with transfer credit should contact the department about special arrangements.

Double Counting: No course may count towards two different majors.

Early Senior Capstone Course: In exceptional circumstances, with the prior permission of the department, a student may be allowed to satisfy the Senior Capstone Course requirement in the junior year, provided that the student has completed at least three 300-level statistics courses before enrolling in the capstone course.

Planning Courses: Core courses are normally offered every year. Other 300 and 400 level statistics courses are offered on an irregular basis. Students should check with the department before planning far into the future.

Course Admission: Courses are normally open to all students meeting the prerequisites, subject to any course caps. Students with questions about the level at which courses are conducted are invited to consult department faculty.

FAQ
Students MUST contact departments/programs BEFORE assuming study away credit will be granted toward the major or concentration.

Can your department or program typically pre-approve courses for major/concentration credit?
Yes, in many cases, though students should be sure to contact the department.

What criteria will typically be used/required to determine whether a student may receive major/concentration credit for a course taken
while on study away?

Course title and description, and complete syllabus including readings/assignments.

Does your department/program place restrictions on the number of major/concentration credits that a student might earn through study away?

No.

Does your department/program place restrictions on the types of courses that can be awarded credit towards your major?

Yes. They have to be approved MATH/STAT courses.

Are there specific major requirements that cannot be fulfilled while on study away?

Yes. Colloquium requirement, Senior Seminar requirement.

Are there specific major requirements in your department/program that students should be particularly aware of when weighing study away options? (Some examples might include a required course that is always taught in one semester, laboratory requirements.)

Yes. The highly cumulative structure of the major.

Give examples in which students thought or assumed that courses taken away would count toward the major or concentration and then learned they wouldn’t:

None to date.

THE DEGREE WITH HONORS IN STATISTICS

The degree with honors in Statistics is awarded to the student who has demonstrated outstanding intellectual achievement in a program of study which extends beyond the requirements of the major. The principal considerations for recommending a student for the degree with honors will be: Mastery of core material and skills, breadth and, particularly, depth of knowledge beyond the core material, ability to pursue independent study of statistics, originality in methods of investigation, and, where appropriate, creativity in research.

An honors program normally consists of two semesters (STAT 493 and 494) and a winter study (WSP 031) of independent research, culminating in a thesis and a presentation. During the Academic Year 2020-2021 the winter study requirement for the honors program in Statistics is waved. One of STAT 493 or STAT 494 can count as a continuation course, but not both. Neither counts as the 400-level senior capstone course.

An honors program in actuarial studies requires significant achievement on four appropriate examinations of the Society of Actuaries.

Highest honors will be reserved for the rare student who has displayed exceptional ability, achievement or originality. Such a student usually will have written a thesis or pursued actuarial honors. In all cases, the award of honors and highest honors is the decision of the Department.

STAT 101  (F)(S)  Elementary Statistics and Data Analysis  (QFR)

It is impossible to be an informed citizen in today’s world without an understanding of data. Whether it is opinion polls, unemployment rates, salary differences between men and women, the efficacy of vaccines, etc, we need to be able to interpret and gain information from statistics. This course will introduce the common methods used to analyze and present data with an emphasis on interpretation and informed decision making.

Requirements/Evaluation: weekly homework, quizzes, exams, and a project

Prerequisites: MATH 102 (or demonstrated proficiency on a diagnostic test)

Enrollment Limit: 50

Enrollment Preferences: juniors and seniors

Expected Class Size: 35

Grading: yes pass/fail option, yes fifth course option

Unit Notes: Students with MATH150 but no statistics should enroll in STAT201. Students with AP Stat 4/5 or STAT 101/161 should enroll in STAT 202.

Distributions: (D3) (QFR)

Quantitative/Formal Reasoning Notes: It is a quantitative course.

Attributes: COGS Related Courses  PHLH Statistics Courses

Fall 2024
STAT 161  (F)(S) Introductory Statistics for Social Science  (QFR)

This course will cover the basics of modern statistical analysis with a view toward applications in the social sciences. Topics include exploratory data analysis, linear regression, basic statistical inference, and elements of probability theory. The course focuses on the application of statistical tools to solve problems, to make decisions, and the use of statistical thinking to understand the world.

Requirements/Evaluation: Weekly homework, quizzes, two midterms and a final exam (midterms include take-home components), and a data analysis project. Students will need to become familiar with the statistical software STATA.

Prerequisites: MATH 130 (or equivalent); not open to students who have completed STAT 101 or equivalent

Enrollment Limit: 40

Enrollment Preferences: Economics majors, sophomores

Expected Class Size: 40

Grading: yes pass/fail option, no fifth course option

Unit Notes: Students with calculus background should consider STAT 201. Students without any calculus background should consider STAT 101. Students with AP Stat 4 or 5 should consider Stat 202. Please refer to the placement chart on the Math&Stat department website for more information.

Distributions: (D3)  (QFR)

Quantitative/Formal Reasoning Notes: Reasoning with data

Attributes: PHLH Statistics Courses

Fall 2024

LEC Section: 01 MWF 9:00 am - 9:50 am  Duncan A. Clark
LEC Section: 02 MWF 11:00 am - 11:50 am  Duncan A. Clark

Spring 2025

LEC Section: 01 MWF 10:00 am - 10:50 am  Duncan A. Clark
LEC Section: 02 MWF 12:00 pm - 12:50 pm  Duncan A. Clark

STAT 197  (F) Independent Study: Statistics

Directed 100-level independent study in Statistics.

Requirements/Evaluation: decided by the department

Prerequisites: permission of department

Enrollment Limit: 20

Enrollment Preferences: decided by the department

Expected Class Size: 1

Grading: yes pass/fail option, yes fifth course option

Distributions: (D3)

Not offered current academic year

STAT 198  (S) Independent Study: Statistics

Directed 100-level independent study in Statistics.

Requirements/Evaluation: decided by the department

Prerequisites: permission of department

Enrollment Limit: 20

Enrollment Preferences: decided by the department
Expected Class Size: 1
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3)
Not offered current academic year

STAT 201 (F)(S) Statistics and Data Analysis (QFR)
Statistics can be viewed as the art and science of turning data into information. Real world decision-making, whether in business or science, is often based on data and the perceived information it contains. Sherlock Holmes, when prematurely asked the merits of a case by Dr. Watson, snapped back, "Data, data, data! I can't make bricks without clay." In this course, we will study the basic methods by which statisticians attempt to extract information from data. These will include many of the standard tools of statistical inference such as hypothesis testing, confidence intervals, and linear regression as well as exploratory and graphical data analysis techniques. This is an accelerated introductory statistics course that involves computational programming and incorporates modern statistical techniques.
Requirements/Evaluation: weekly homework and projects, midterm exams, and a final exam.
Prerequisites: MATH 150 or equivalent; not open to students who have completed STAT 101 or STAT 161 or equivalent
Enrollment Limit: 40
Enrollment Preferences: Prospective Statistics majors, students for whom the course is a major prerequisite, and seniors
Expected Class Size: 40
Grading: yes pass/fail option, yes fifth course option

Unit Notes: Students with AP Stat 4/5 or STAT 101/161 should enroll in STAT 202. Students with no calc or stats background should enroll in STAT 101. Students with MATH 140 but no statistics should enroll in STAT 161.
Distributions: (D3) (QFR)
Quantitative/Formal Reasoning Notes: Students will learn to choose, carry out, interpret, and communicate analyses of data.
Attributes: COGS Related Courses PHLH Statistics Courses

Fall 2024
LEC Section: 01 TF 1:10 pm - 2:25 pm Elizabeth M. Upton

Spring 2025
LEC Section: 01 TF 1:10 pm - 2:25 pm Elizabeth M. Upton

STAT 202 (F)(S) Introduction to Statistical Modeling (QFR)
Data come from a variety of sources: sometimes from planned experiments or designed surveys, sometimes by less organized means. In this course we'll explore the kinds of models and predictions that we can make from both kinds of data, as well as design aspects of collecting data. We'll focus on model building, especially multiple regression, and talk about its potential to answer questions about the world -- and about its limitations. We'll emphasize applications over theory and analyze real data sets throughout the course.
Requirements/Evaluation: Homework problems; quizzes; exams; a final project (on a topic that interests you!). Participation matters! Engagement with your peers is an important part of learning, of being a statistician in the Real World...and of your evaluation in this course. While your assignments will be submitted (and graded) individually, you'll be responsible for giving and receiving peer feedback, contributing to class discussions, and working together with classmates on practice problems.
Prerequisites: MATH 140 and STAT 101/161/201/AP Statistics 4/5, or permission of instructor.
Enrollment Limit: 40
Enrollment Preferences: Prospective Statistics majors and more senior students
Expected Class Size: 25
Grading: yes pass/fail option, yes fifth course option
Unit Notes: Students with a 4 on the AP Stats exam should contact the department for proper placement. Students with STAT 201 are strongly encouraged to take STAT 346 or other 300-level statistics electives.
Distributions: (D3) (QFR)
Quantitative/Formal Reasoning Notes: This course uses mathematical tools and computing programs to create models, make predictions, assess uncertainty, and describe data. We'll also emphasize choosing appropriate mathematical tools and interpreting their results in a real-world context.

Attributes: PHLH Statistics Courses

Fall 2024
LEC Section: 01 TR 8:30 am - 9:45 am Anna C. Neufeld
LEC Section: 02 TR 9:55 am - 11:10 am Anna C. Neufeld

Spring 2025
LEC Section: 01 TR 8:30 am - 9:45 am Anna C. Neufeld
LEC Section: 02 TF 1:10 pm - 2:25 pm Xizhen Cai

STAT 297 (F) Independent Study: Statistics
Directed 200-level independent study in Statistics.
Requirements/Evaluation: decided by the department
Prerequisites: permission of department
Enrollment Limit: 20
Enrollment Preferences: decided by the department
Expected Class Size: 1
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3)
Not offered current academic year

STAT 298 (S) Independent Study: Statistics
Directed 200-level independent study in Statistics.
Requirements/Evaluation: decided by the department
Prerequisites: permission of department
Enrollment Limit: 20
Enrollment Preferences: decided by the department
Expected Class Size: 1
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3)
Not offered current academic year

STAT 335 (S) Introduction to Biostatistics and Epidemiology (QFR)
Epidemiology is the study of disease and disability in human populations, while biostatistics focuses on the development and application of statistical methods to address questions that arise in medicine, public health, or biology. This course will begin with epidemiological study designs and core concepts in epidemiology, followed by key statistical methods in public health research. Topics will include multiple regression, analysis of categorical data (two sample methods, sets of 2x2 tables, RxC tables, and logistic regression), survival analysis (Cox proportional hazards model), and if time permits, a brief introduction to regression with correlated data.
Requirements/Evaluation: Evaluation will be primarily based on weekly assignments (regular homework or mini-projects), two midterm exams, and a final exam.
Prerequisites: Stat 201 or Stat 202, or permission of instructor (prior experience should include a working understanding of multiple linear regression, the basics of statistical inference, and R).
Enrollment Limit: 20
Enrollment Preferences: Statistics majors and prospective majors who have not yet taken Stat 346; public health concentrators
Expected Class Size: 20
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3) (QFR)
Quantitative/Formal Reasoning Notes: Students will learn how to choose, implement, and interpret statistical analyses relevant to public health studies.
Attributes: PHLH Statistics Courses

Spring 2025
LEC Section: 01 MWF 12:00 pm - 12:50 pm Anna M. Plantinga

STAT 341 (F)(S) Probability (QFR)
Cross-listings: MATH 341

Secondary Cross-listing
The historical roots of probability lie in the study of games of chance. Modern probability, however, is a mathematical discipline that has wide applications in a myriad of other mathematical and physical sciences. Drawing on classical gaming examples for motivation, this course will present axiomatic and mathematical aspects of probability. Included will be discussions of random variables (both discrete and continuous), distribution and expectation, independence, laws of large numbers, and the well-known Central Limit Theorem. Many interesting and important applications will also be presented, including some from classical Poisson processes, random walks and Markov Chains.

Requirements/Evaluation: homework, classwork, and exams
Prerequisites: MATH 150 and MATH 250 or permission of the instructor
Enrollment Limit: 50
Enrollment Preferences: Priority will be given to Mathematics majors and to Statistics Majors.
Expected Class Size: 20
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3) (QFR)
This course is cross-listed and the prefixes carry the following divisional credit:
STAT 341(D3) MATH 341(D3)
Quantitative/Formal Reasoning Notes: This is a 300-level Math/Stat course.

Fall 2024
LEC Section: 01 MWF 12:00 pm - 12:50 pm Mihai Stoiciu

Spring 2025
LEC Section: 01 TR 9:55 am - 11:10 am Steven J. Miller

STAT 342 (S) Introduction to Stochastic Processes (QFR)
Stochastic processes are mathematical models for random phenomena evolving in time or space. Examples include the number of people in a queue at time t or the accumulated claims paid by an insurance company in an interval of time t. This course introduces the basic concepts and techniques of stochastic processes used to construct models for a variety of problems of practical interest. The theory of Markov chains will guide our discussion as we cover topics such as martingales, random walks, Poisson process, birth and death processes, and Brownian motion.

Requirements/Evaluation: weekly homework/labs, classwork, and exams
Prerequisites: STAT 341
Enrollment Limit: 30
Enrollment Preferences: senior Statistics majors
Expected Class Size: 15
Grading: yes pass/fail option, yes fifth course option
STAT 344 (S) Statistical Design of Experiments  (QFR)
When you hear the word experiment you might be picturing white lab coats and pipettes, but businesses, especially e-commerce, are constantly experimenting as well. How do you get the most out of both scientific and business investigations? By doing the right experiment in the first place. We'll explore the techniques used to plan experiments that are both efficient and statistically sound. We'll learn how to analyze the data that come from these experiments and the conclusions we can draw from that analysis. We'll look at both classical tools like fractional factorial designs as well as optimal design, and see how these two frameworks differ in their philosophy and in what they can do. Throughout the course, we'll make extensive use of both R and JMP software to work with real-world data.

Requirements/Evaluation:  Homework problems--both individual and in groups, midterm, final, and projects (on topics that interest you!).
Prerequisites:  STAT 161 or 201 or 202, or equivalent, and Math 140 or equivalent, or permission of instructor
Enrollment Limit:  20
Enrollment Preferences:  Statistics majors, seniors, juniors, sophomores, first years
Expected Class Size:  15
Grading:  yes pass/fail option,  yes fifth course option
Distributions:  (D3)  (QFR)
Quantitative/Formal Reasoning Notes: This course uses mathematical tools and computing programs to design experiments, analyze their results, and assess their effectiveness. We'll also emphasize choosing appropriate mathematical tools and interpreting their results in a real-world context.
STAT 355 (F) Multivariate Statistical Analysis (QFR)
To better understand complex processes, we study how variables are related to one another and how they work in combination. In addition, we want to make inferences about more than one variable at a time. Elementary statistical methods might not apply. In this course, we study the tools and the intuition that are necessary to analyze and describe such datasets with more than multiple variables. Topics covered will include data visualization techniques for data sets with more variables, clustering algorithms, parametric and non-parametric techniques to estimate joint distributions, techniques for combining variables, performing dimension reduction, and making inferences.

Requirements/Evaluation: Homework, projects, quizzes, and exams.
Prerequisites: MATH 250, and STAT 346 or permission of instructor
Enrollment Limit: 15
Enrollment Preferences: Juniors/seniors
Expected Class Size: 10
Grading: yes pass/fail option, no fifth course option
Distributions: (D3) (QFR)
Quantitative/Formal Reasoning Notes: It is an advanced statistics class with prerequisites that are QFR courses

Fall 2024
LEC Section: 01 TF 1:10 pm - 2:25 pm Xizhen Cai

STAT 356 (F) Time Series Analysis (QFR)
Time series -- data collected over time -- crop up in applications from economics to engineering to transit. But because the observations are generally not independent, we need special methods to investigate them. This course will include exploratory methods and modeling for time series, including descriptive methods and checking for significance, and a foray into the frequency domain. We will emphasize applications to a variety of real data, explored using R.

Requirements/Evaluation: Evaluation is primarily based on quizzes and projects (on topics that interest you!). You'll be given the opportunity to assess your own work and resubmit/reattempt assignments as you gain mastery of a topic. Participation matters! Engagement with your peers is an important part of learning, of being a statistician in the Real World...and of your evaluation in this course. While most assignments will be submitted (and graded) individually, you'll be responsible for giving and receiving peer feedback, contributing to live and online discussions, and working together with classmates on practice problems.
Prerequisites: STAT 346 (may be taken concurrently) or permission of instructor
Enrollment Limit: 15
Enrollment Preferences: Statistics majors, seniors
Expected Class Size: 15
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3) (QFR)
Quantitative/Formal Reasoning Notes: This course uses mathematical tools and computing programs to create models, make predictions, assess uncertainty, and describe data. We'll also emphasize choosing appropriate mathematical tools and interpreting their results in a real-world context.

Not offered current academic year

STAT 360 (F) Statistical Inference (QFR)
How do we estimate unknown parameters and express the uncertainty we have in our estimate? Is there an estimator that works best? Many topics from introductory statistics such as random variables, the central limit theorem, point and interval estimation and hypotheses testing will be revisited and put on a more rigorous mathematical footing. The focus is on maximum likelihood estimators and their properties. Bayesian and computer intensive resampling techniques (e.g., the bootstrap) will also be considered.

Requirements/Evaluation: Homework, Quizzes, Exams
Prerequisites: MATH 250, STAT 201 or 202, STAT 341
Enrollment Limit: 15
Enrollment Preferences: Statistics majors
Expected Class Size: 15
Grading: no pass/fail option, yes fifth course option
Distributions: (D3) (QFR)
Quantitative/Formal Reasoning Notes: A rigorous mathematical course laying the foundation for reasoning with data

Fall 2024
LEC Section: 01  MWF 10:00 am - 10:50 am  Richard D. De Veaux

STAT 365 (S) Bayesian Statistics (QFR)
The Bayesian approach to statistical inference represents a reversal of traditional (or frequentist) inference, in which data are viewed as being fixed and model parameters as unknown quantities. Interest and application of Bayesian methods have exploded in recent decades, being facilitated by recent advances in computational power. We begin with an introduction to Bayes’ Theorem, the theoretical underpinning of Bayesian statistics which dates back to the 1700's, and the concepts of prior and posterior distributions, conjugacy, and closed-form Bayesian inference. Building on this, we introduce modern computational approaches to Bayesian inference, including Markov chain Monte Carlo (MCMC), Metropolis-Hastings sampling, and the theory underlying these simple and powerful methods. Students will become comfortable with modern software tools for MCMC using a variety of applied hierarchical modeling examples, and will use R for all statistical computing.

Requirements/Evaluation: weekly homework and exams
Prerequisites: MATH/STAT 341 and STAT 346, or permission of instructor
Enrollment Limit: 20
Enrollment Preferences: juniors and seniors, Statistics majors, students who have taken STAT 360
Expected Class Size: 15
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3) (QFR)
Quantitative/Formal Reasoning Notes: This course utilizes mathematics and computer-based tools for the Bayesian approach for analyzing data and making statistical inferences.

Not offered current academic year

STAT 372 (S) Longitudinal Data Analysis (QFR)
This course explores modern statistical methods for drawing scientific inferences from longitudinal data, i.e., data collected repeatedly on experimental units over time. The independence assumption made for most classical statistical methods does not hold with this data structure because we have multiple measurements on each individual. Topics will include linear and generalized linear models for correlated data, including marginal and random effect models, as well as computational issues and methods for fitting these models. As time permits, we will also investigate joint modeling of longitudinal and time-to-event data. We will consider many applications in the social and biological sciences.

Requirements/Evaluation: Weekly homework, midterm exams, a final exam, and a data analysis project
Prerequisites: STAT 346 (and an appropriate introductory statistics course, typically STAT 201 or 202)
Enrollment Limit: 20
Enrollment Preferences: junior and senior Statistics majors
Expected Class Size: 15
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3) (QFR)
Quantitative/Formal Reasoning Notes: The course will cover a variety of statistical analysis methods for longitudinal data.
Attributes: PHLH Statistics Courses

Not offered current academic year
STAT 397 (F) Independent Study: Statistics
Directed independent study in Statistics.
Prerequisites: permission of department
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3)
Not offered current academic year

STAT 398 (S) Independent Study: Statistics
Directed independent study in Statistics.
Prerequisites: permission of department
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3)
Not offered current academic year

STAT 440 (S) Categorical Data Analysis (QFR)
This course focuses on methods for analyzing categorical response data. Traditional tools of statistical data analysis for continuous response data are not designed to handle such data and pose inappropriate assumptions. We will develop methods specifically designed to address the discrete nature of the observations and consider many applications in the social and biological sciences as well as in medicine, engineering and economics. The first part of the course will discuss statistical inference for parameters of categorical distributions and arising in contingency tables. The longer second part will focus on statistical modeling via generalized linear models for binary, multinomial, ordinal and count response variables, using maximum likelihood.
Requirements/Evaluation: Class participation and performance on exams, homework, and a project.
Prerequisites: STAT 346 and STAT 360
Enrollment Limit: 15
Enrollment Preferences: seniors and statistics majors
Expected Class Size: 12
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3) (QFR)
Quantitative/Formal Reasoning Notes: Arguing with data.
Attributes: PHLH Statistics Courses
Not offered current academic year

STAT 442 (S) Statistical Learning and Data Mining (QFR)
In both science and industry today, the ability to collect and store data can outpace our ability to analyze it. Traditional techniques in statistics are often unable to cope with the size and complexity of today's data bases and data warehouses. New methodologies in Statistics have recently been developed, designed to address these inadequacies, emphasizing visualization, exploration and empirical model building at the expense of traditional hypothesis testing. In this course we will examine these new techniques and apply them to a variety of real data sets.
Class Format: Students cannot take both STAT 315 and STAT 442. Only one of the two can be taken for credit.
Requirements/Evaluation: class participation, weekly homework, exams and an end-of-term project
Prerequisites: MATH/STAT 341 and STAT 346, or permission of instructor
Enrollment Limit: 20
Enrollment Preferences: Statistics majors, juniors and seniors. Students cannot take both STAT 315 and STAT 442. Only one of the two can be taken for credit.
Expected Class Size: 15
Grading: yes pass/fail option, yes fifth course option
Distributions: (D3) (QFR)
**Quantitative/Formal Reasoning Notes:** This is an advanced statistics class involving theory and application of statistical methods to data.

Spring 2025

LEC Section: 01  MR 2:35 pm - 3:50 pm  Anna C. Neufeld

**STAT 458 (F) Generalized Linear Models- Theory and Applications**  (QFR)

This course will explore generalized linear models (GLMs)--the extension of linear models, discussed in Stat346, to response variables that have specific non-normal distributions, such as counts and proportions. We will consider the general structure and theory of GLMs and see their use in a range of applications. As time permits, we will also examine extensions of these models for clustered data such as mixed effects models and generalized estimating equations.

**Requirements/Evaluation:** Weekly homework consisting of theoretical exercises and data analyses carried out in R. Short frequent quizzes and one midterm (with an in-class and take-home component). Final project and final exam.

**Prerequisites:** STAT 346, or permission of instructor

**Enrollment Limit:** 20

**Enrollment Preferences:** Seniors and Statistics majors

**Expected Class Size:** 10

**Grading:** yes pass/fail option, yes fifth course option

**Distributions:** (D3)  (QFR)

**Quantitative/Formal Reasoning Notes:** This is an intensive statistics course, involving theoretical and mathematical reasoning as well as the application of mathematical ideas to data using software.

Fall 2024

LEC Section: 01  TF 2:35 pm - 3:50 pm  Elizabeth M. Upton

**STAT 465 (S) Bayesian Statistics**  (QFR)

Prior knowledge being constantly updated by empirical observations -- the essence of Bayesian thinking provides a natural, intuitive, and more importantly, mathematically sounded, probabilistically principled way to characterize the process of learning. With some of its key ideas formulated based on Bayes’ Theorem dating back to 18th century, Bayesian inference is one of oldest schools of statistics (more than a century earlier than the Frequentist!). Yet it was not until the recent developments in sampling algorithms and computational powers that Bayesian inference gained its revival. Bayesian, and Bayesian-based methods, with their flexibilities in modeling (generative) process of data, interpretability with posterior probability statements, and coherent principles to incorporate empirical evidence a priori, have played key roles in modern data analysis, especially for those “big data” with enhanced complexity and connectivity. This course is designed to provide students a comprehensive understanding to what is Bayesian and the how's and why's. Students will be introduced to classic Bayesian models, basic computational algorithms/methods for Bayesian inference, as well as their applications in various fields, and comparisons with classic Frequentist methods. As Bayesian inference finds its roots and merits particularly in application, this course puts great emphasis on enhancing students’ skills in statistical computation (mostly with R) and data analysis.

**Requirements/Evaluation:** Homework, exams, and project

**Prerequisites:** MATH/STAT 341, STAT 346, and STAT 360, or permission of instructor

**Enrollment Limit:** 20

**Enrollment Preferences:** seniors, Statistics majors

**Expected Class Size:** 15

**Grading:** yes pass/fail option, yes fifth course option

**Distributions:** (D3)  (QFR)

**Quantitative/Formal Reasoning Notes:** This course utilizes mathematics and computer-based tools for the Bayesian approach for analyzing data and making statistical inferences.

Not offered current academic year
STAT 493  (F)(S)  Senior Thesis: Statistics
Each student carries out an individual research project under the direction of a faculty member that culminates in a thesis. See description under The Degree with Honors in Statistics.

Grading:  yes pass/fail option,    yes fifth course option
Distributions:  (D3)

Fall 2024
HON Section: 01    TBA    Richard D. De Veaux
Spring 2025
HON Section: 01    TBA    Richard D. De Veaux

STAT 494  (S)  Senior Thesis: Statistics
Each student carries out an individual research project under the direction of a faculty member that culminates in a thesis. See description under The Degree with Honors in Statistics.

Grading:  yes pass/fail option,    yes fifth course option
Distributions:  (D3)

Not offered current academic year

STAT 497  (F)(S)  Independent Study: Statistics
Directed independent study in Statistics.

Prerequisites:  permission of department
Grading:  yes pass/fail option,    yes fifth course option
Distributions:  (D3)

Fall 2024
IND Section: 01    TBA    Richard D. De Veaux
Spring 2025
IND Section: 01    TBA    Richard D. De Veaux

STAT 498  (S)  Independent Study: Statistics
Directed independent study in Statistics.

Prerequisites:  permission of department
Grading:  yes pass/fail option,    yes fifth course option
Distributions:  (D3)

Not offered current academic year

STAT 499  (F)(S)  Statistics Colloquium
Statistics senior colloquium. Meets every week for an hour both fall and spring. Senior statistics majors must participate. This colloquium is in addition to the regular four semester-courses taken by all students.

Requirements/Evaluation:  delivering a passing talk and participation throughout the year
Prerequisites:  Statistics majors must take the colloquium in their senior year
Enrollment Limit:  none
Enrollment Preferences:  none
Expected Class Size:  25
Grading:  non-graded
Distributions: (D3)

Fall 2024
SEM Section: 01    W 1:10 pm - 3:50 pm    Richard D. De Veaux

Spring 2025
SEM Section: 01    W 1:10 pm - 3:50 pm    Richard D. De Veaux

Winter Study  -------------------------------------------------------------

STAT 30  (W)  Senior Project: Statistics
To be taken by candidates for honors in Statistics other than by thesis route.
Class Format: senior project
Grading:    pass/fail only
Not offered current academic year

STAT 31  (W)  Senior Honors Thesis
Statistics senior honors thesis.
Class Format: thesis
Grading:    pass/fail only
Not offered current academic year

STAT 99  (W)  Indep Study: Statistics
Open to upperclass students. Students interested in doing an independent project (99) during Winter Study must make prior arrangements with a faculty sponsor. The student and professor then complete the independent study proposal form available online. The deadline is typically in late September. Proposals are reviewed by the pertinent department and the Winter Study Committee. Students will be notified if their proposal is approved prior to the Winter Study registration period.
Class Format: independent study
Grading:    pass/fail only
Not offered current academic year