Biometry and Statistics/Statistical Science

Major Requirements

Required Courses

*All required classes must be taken for letter grade, only grades of C- or higher will count towards major requirements.*

**Calculus 1 & 2:** MATH 1110-1120/1220 or 1910 Calculus 1 & 2

**Multivariable Calculus and Linear Algebra:** MATH 2210-2220 or 2230-2240 or 1920&2940 or 2130&2310

**Statistical Methods I:** BTRY 3010/STSCI 2200

- Equivalents include AEM 2100, BTRY 6010, ENGRD 2700, HADM 2100, MATH 1710, PAM 2100/2101, PSYCH 3500, SOC 3010, STSCI 2150.
- Students with a score of 4 or better in AP Statistics may have this requirement waived (not recommended)

**Statistical Methods II:** BTRY 3020/STSCI 3200

**Probability:** BTRY/STSCI 3080 or MATH 4710

- Alternatives include ECON 3130 and ORIE 3500

**Linear Models:** BTRY/STSCI 4030: Linear Models with Matrices

- ECON 3140 is an alternative.

**Theory of Statistics:** BTRY/STSCI 4090, or MATH 4720

**Statistical Computing:** BTRY 4520

**Students entering the major as sophomores** (including transfers and Arts and Sciences students declaring a major) must have completed Calculus I & II and Statistical Methods I.

**Students entering as juniors** must have also completed Statistical Methods II and Multivariable Calculus and Linear Algebra.

ECON 3110 and/or ECON 3120 may be substituted for Probability and Linear Models respectively *only* by double majors in Economics if taken prior to joining Statistical Science.

Elective Courses

Students must additionally complete two courses from the Statistical Methods Electives list below, and another 3 courses of Related Electives that make a thematically-linked sequence.
**Statistical Methods Electives**

BTRY/STSCI 3090: Theory of Interest

BTRY/STSCI/ILRST 3100: Statistical Sampling

STSCI/ORIE 3510: Introduction to Engineering Stochastic Processes I

STSCI/ILRST 4010: Great Ideas in Statistics

STSCI 4060: Python Programming and its Applications in Statistics

BTRY/STSCI/ILRST 4100: Multivariate Analysis

BTRY/STSCI/ILRST 4110: Categorical Data

STSCI 4120: Nonparametric Inference and Sequential Analysis

BTRY/STSCI/ILRST 4140: Applied Design

BTRY/STSCI 4270: Introduction to Survival Analysis

STSCI/ILRST 4550: Applied Time Series Analysis; cross-listed as ORIE 5550

STSCI 4740: Data Mining and Machine Learning

STSCI 4780: Bayesian Data Analysis: Principles and Practice

STSCI/ORIE 5640: Statistics for Financial Engineering

ECON 4110 Cross Section and Panel Econometrics

BTRY 4820: Statistical Genomics

NTRES 6700: Spatial Statistics

ORIE 4741: Learning with Big Messy Data

*BTRY 4980, 4990 and STSCI 4970, 4990 are recommended, but cannot be used for major requirements.*

**External Electives**

Three thematically-linked courses covering related topics to statistics. The courses should either have a quantitative component that involves probabilistic reasoning or covers mathematical or computational tools that are used within statistics.

**CS 1110: Introduction to Computing Using Python** or **CS 1112: Introduction to Computing Using Matlab** may be used as one of these courses in conjunction with two others in any discipline. This is strongly recommended for anyone without prior programing experience.

Courses from the Statistical Methods list may be used to satisfy this requirement, but no course can be used for both requirements. Unless otherwise noted all courses should be taken at the 3000 level or above. Example sequences are provided on the Statistical Science and Biometry and Statistics websites.

Potential course sequence suggestions are given at the end of this document.
General Information

**Grades:** Courses required for the major must be taken for letter grades. To remain in good standing in the major, a student must have a GPA of at least 2.3 in all courses required for the major including advanced electives. A student must earn a grade of C- or better in every required course; if a student receives a lower grade in a required course, the course can be retaken until a C- or better is earned, or the requirement can be satisfied by another course. If these requirements are not met, a student may, if desired, transfer to the General Studies major but still complete the coursework required for the major.

**Course substitutions:** If a student’s faculty advisor approves in advance, the student may substitute a similar course for a requirement of the Biometry and Statistics major. For example, BTRY 4090 may be replaced by another suitable course in the theory of statistics, such as MATH 4720.

**Counting courses not on the Statistical Methods list as electives:** Students may petition to have courses not on the Statistical Methods count as electives for the major. Decisions about petitions will be made by a committee of the Statistics faculty. Courses that are approved as electives through the petition process will be added to the list.

**Double majors:** A student may fulfill the requirements of two distinct majors. If both majors are in the same college, the double major can be officially recognized. If you wish to do this, you should discuss your situation as early as possible with the Director of Undergraduate Studies or Undergraduate Advising Coordinator of the home department of the second major. A faculty advisor in the second major should be arranged.

**Transferring credits to the major:** It is important to distinguish between transfer credits toward graduation, which are evaluated by your college Registrar’s Office, and transfer credits toward the major, which are evaluated by the statistics faculty. It is the individual student’s responsibility to provide sufficient information to the Registrar’s Office and the statistics faculty for evaluation of transfer credits, including Advanced Placement credits.

**Transferring into the major/Declaring a major:** A student must be in good academic standing in the program from which the student is transferring and also by the standards of their college. To transfer in as a sophomore, a student must have completed one year (two semesters) of calculus with an average grade of B- or better and must have taken at least one course in statistics. To transfer in as a junior, a student must have completed one year (two semesters) of calculus with an average grade of B- or better and must have taken at least two courses in statistics. Transfer students will be exempted from all required courses for which they have taken equivalent courses at other colleges or universities. A student transferring into the major must meet with the student’s faculty advisor to discuss and determine which required courses the student has been exempted from taking.
Suggested External Electives

The following are suggested external elective subjects along with potential courses. This list is not exhaustive and any external elective sequence should be agreed on with your faculty advisor.

Note that individual courses may not be available some years and specific course offerings may change.

Mathematical Statistics (recommended if you are considering graduate school in statistics)

MATH 3110/4130: Mathematical Analysis and two of

Any MATH classes at the 3000 level or above

CS 2110: Object Oriented Programming

ORIE 3300/3310: Optimization

ORIE 4580: Simulation Modeling and Analysis

CS 3220 or CS 4220: Scientific Computing and Numerical Analysis

Statistical Methods

Three further courses from the Statistical Methods electives.

Computational Statistics and Data Management

STSCI 4060: Python Programming and its Applications in Statistics

CS 2110: Object Oriented Programming

CS 3110: Data Structures and Functional Programming

CS 4320: Introduction to Database Systems

CS 4786: Machine Learning for Data Science

INFO 3300: Data Driven Web Applications

ORIE 3120: Practical Tools for Operations Research, Machine Learning and Data Science
Statistics, Policy and Communication
COMM 4860: Risk Communication
ILRST: The Ethics of Data Analysis
INFO 4200: Information Policy: Research, Analysis and Design
INFO 4250: Surveillance and Privacy
INFO 4270: Ethics and Policy in Data Science
INFO 4700: Data and Algorithms in Public Life
STS 3020: Science Writing for the Media
STS 3811/PHIL 3810: Philosophy of Science

Economics
Any ECON courses at 4000 level or above, but particularly
ECON 4020: Game Theory
ECON 4110: Cross Section and Panel Econometrics
ECON 4120: Time Series Econometrics
ECON 4220: Financial Econometrics

Actuarial Studies
BTRY/STSCI 3090: Theory of Interest
BTRY/STSIC 4270: Survival Analysis
STSCI/ORIE 4550: Applied Time Series Analysis
AEM 2241: Finance or ECON 4220: Financial Economics
AEM 4210: Futures, Options and Financial Derivatives or ECON 4220: Financial Economics
STSCI/ORIE 5640: Statistics for Financial Engineering
Finance
AEM 4210: Futures, Options and Financial Derivatives
ECON 4220: Financial Economics
ECON 4902: Banks
HADM 2250: Finance
ORIE 4742: Information Theory, Probabilistic Modeling, and Deep Learning, with Scientific and Financial Applications
ORIE 4820: Spreadsheet-Based Modeling and Data Analysis

Statistical Genetics
BIOMG 2800: Genetics and two of
BIOMG 4870: Human Genetics
BTRY 4381: Bioinformatics Programming
BTRY 4810: Population Genetics
BTRY 4820: Statistical Genomics
BTRY 4830: Quantitative Genomics and Genetics
BTRY 4840: Computational Genetics and Genomics
ENTOM 4610: Model-based Phylogenetics and Hypothesis Testing
ENTOM 4700: Ecological Genetics

Information Sciences
INFO 3300: Data-Driven Web Applications
INFO 3350: Text Mining History and Literature
INFO 4154: Analytics-driven Game Design
INFO 4310: Interactive Information Visualization
Computer Science and Machine Learning
CS 2110: Object-Oriented Programming
CS 3220 or CS 4220: Scientific Computing and Numerical Analysis
CS 4700: Foundations of Artificial Intelligence
CS 4740: Natural Language Processing
CS 4780: Machine Learning
ORIE 4741: Learning with Big Messy Data
ORIE 4742: Information Theory, Probabilistic Modeling, and Deep Learning, with Scientific and Financial Applications
ORIE 6741: Bayesian Machine Learning

Quantitative Biology and Ecology
BIONB 3300: Computational Neuroscience
BIONB 4220: Modeling Behavioral Evolution
ENTOM 4700: Ecological Genetics
MATH 3610: Dynamic Models in Biology
NTRES 4110: Quantitative Ecology & Management of Fisheries Resources
NTRES 4120: Wildlife Population Analysis
VTPMD 6660: Advanced Methods in Epidemiology