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INFORMATION ABOUT STATISTICS PROGRAM AT HAVERFORD

Haverford College offers a wide range of courses on statistical theory and applications. This document/website is intended to help students who are contemplating taking one or more statistics courses decide which would be the best. It is, of course, very important for students also to discuss their course selections with their faculty advisors.

This information is organized as follows:

QUICK INFORMATION: WHAT STATISTICS COURSES SHOULD I TAKE?

1. Introductory Statistics

There are **6** introductory statistics courses offered at Haverford. The courses and their corresponding college division distributions are summarized in the following table:

Course	College Distribution	Comments
ECON 203*	SO/QU	Economics majors and minors are required to take either Econ 203 or Econ204
ECON 204*	SO/QU	
MATH103	NA/QU	Designed for students with weak math backgrounds
STAT/MATH203*	NA/QU	200-level math elective
PSYC 200	SO/QU	Required for psychology major
SOCL 215*	SO/QU	Required for sociology major

*** Normally students are not allowed to take more than one of the following four courses: ECON203, ECON204, STAT/MATH203, and SOCL215.** In special cases, and only with permission of the chair of the department offering the course, a student may take more than one of the above four courses.

2. Intermediate Statistics Courses

- ECON304 (Introduction to Econometrics)
- MATH218 (Probability)
- STAT/MATH286 (Applied Multivariate Statistical Analysis)

3. Upper Level Statistics Courses

- STAT/MATH328 (Mathematical Statistics)
- STAT/MATH396 (Advanced Topics in Probability and Statistics)

Detailed course descriptions, complete guidelines for choosing statistics courses and the statistics minor requirement are available below.

DETAILED COURSE INFORMATION

Introductory Statistics Courses Offered at Haverford (Total six courses)

Economics H203: Statistical Methods in Economics
Economics H204: Economic Statistics with Calculus
Mathematics H103: Introduction to Probability and Statistics
Statistics/Mathematics H203: Statistical Methods and Their Applications
Psychology H200: Experimental Methods and Statistics
Sociology H215: Quantitative Methods

Economics H203: Statistical Methods in Economics
Economics H204: Economic Statistics with Calculus

In both courses, the topics covered in the regular class meetings include descriptive statistics, elementary probability, random variables and sampling distributions, confidence intervals and hypothesis testing, and an introduction to regression analysis. In the lab portion of both courses, students work in small groups on a semester-long project in which they obtain and analyze primary data on a social or economic issue of their choosing. Students write an original research paper that presents their findings. These courses are substitutes for each other: all students majoring or minoring in economics are required to take one of these two courses, but no student should take both of them.

Requirements fulfilled

Economics major

Economics majors must usually take either ECON H203 or ECON H204. With the permission of the chair of the Economics Department, STAT/MATH H203 may be taken instead of ECON 203 or ECON 204.

Economics minor

Economics minors must usually take either ECON H203 or ECON H204. With the permission of the chair of the Economics Department, STAT/MATH H203 may be taken instead of ECON 203 or ECON 204.

Mathematics major and minor

ECON H204 (not ECON H203) counts as one of the 200-level math electives.

Statistics minor

ECON H204 (not ECON H203) counts towards statistics minor.

Math major with Econ. Concentration

ECON H204 (not ECON H203) is required by the math/econ concentration.

College graduation requirements

Both courses count as one social science (SO) credit.

Both courses satisfy the quantitative reasoning (QU) requirement.

Frequency: Each of these courses is usually offered once per year.

Comparable courses offered at Bryn Mawr College

ECON B253: Introduction to Econometrics is similar to ECON H203, except that ECON B253 does not include a lab. Students majoring or minoring in economics at Haverford may take ECON B253 instead of ECON H203.

Mathematics H103: Introduction to Probability and Statistics. This course covers descriptive statistics, probability, basic ideas of confidence intervals and hypothesis testing, and simple regression. It is ***not*** open to students who have taken Math118 or higher; or who have placed into Math121 or higher; or who have taken any other introductory statistics at Haverford or Bryn Mawr, except with special permission.

Requirements fulfilled

Major and minor requirements

This course does **not** fulfill the requirements of any major or minor at Haverford College.

College graduation requirements

Counts as one natural science (NA) credit.

Satisfies the quantitative reasoning (QU) requirement.

***Frequency*:** Usually offered once every year.

Comparable courses offered at Bryn Mawr College

MATH B104: Probability and Statistics, is similar to MATH H103.

Statistics/Mathematics H203: **Statistical Methods and Their Applications.** The topics covered: descriptive statistics (both numerical and graphical), probability (including random variables, expected values and variances), sampling distributions, one-sample and two-sample inferences, chi-square tests on categorical data, and simple regression with inference on regression parameters and predicted values and analysis of variance.

Requirements fulfilled

Mathematics major

For the mathematics major, this course counts as one 200-level elective.

Mathematics minor

For the mathematics minor, this course counts as one 200-level elective.

Economics major and minor

With permission from the economics department chair, economics majors and minors may take STAT/MATH H203 instead of ECON H203 or ECON H204.

Math major with econ concentration

With permission from the math/econ coordinator, this course may substitute Econ204.

Statistics minor

This course counts towards statistics minor.

College graduation requirements

Counts as one natural science (NA) credit.

Satisfies the quantitative reasoning (QU) requirement.

***Frequency*:** Usually offered once every semester.

Comparable courses offered at Bryn Mawr College: None.

Psychology H200: Experimental Methods and Statistics. Topics covered in this course include research methods, experimental and non-experimental designs and descriptive statistics, measurement issues, hypothesis testing, correlation and regression, t-tests, analysis of variance (one-way, two-way and repeated measure), nonparametric inference and best practices for open science. Students learn SPSS with syntax in lab.

Requirements fulfilled

Psychology major

This course is a requirement for the psychology major.

Statistics minor

This course counts towards statistics minor.

College graduation requirements

Counts as one social science (SO) credit.

Satisfies the quantitative reasoning (QU) requirement.

***Frequency*:** Usually offered once every semester.

Comparable courses offered at Bryn Mawr College

PSYC B205: Experimental Methods and Statistics, is similar to PSYC H200.

Sociology H215: Quantitative Methods. The topics covered in this course include descriptive statistics (including graphic representation), causality, probability, statistical inference, and an introduction to linear and logistic regression. The students learn to use statistical software and work on an original research paper using available datasets.

Requirements fulfilled

Sociology major

This course is a requirement for the sociology major.

Sociology minor

This course is a requirement for the sociology minor.

Statistics minor

This course counts towards statistics minor.

College graduation requirements

Counts as one social science (SO) credit.

Satisfies the quantitative reasoning (QU) requirement.

***Frequency*:** Usually offered once every year.

Comparable courses offered at Bryn Mawr College:

SOCL B265: Quantitative Methods, is similar to SOCL H215.

Intermediate and Advanced Statistics Courses

Five statistics courses at the intermediate or advanced level are offered at Haverford:

Economics H304: Introduction to Econometrics
Mathematics H218: Probability
Statistics/Mathematics H286: Applied Multivariate Statistical Analysis
Statistics/Mathematics H328: Mathematical Statistics
Statistics/Mathematics H396: Advanced Topics in Probability and Statistics

Economics H304: Introduction to Econometrics.

This course covers many of the statistical techniques used in economic research and how to apply them to real world data to test economic hypotheses. The principle statistical framework developed in the course is multiple regression analysis using ordinary least squares. Once the basics of this technique are established, the course explores alternative techniques, such as weighted least squares, models with nonlinear forms, instrumental variables, and maximum likelihood estimation , which are often used when the fundamental assumptions of ordinary least squares are violated.

Requirements fulfilled

Economics major

This course is a requirement for the economics major.

Economics minor

Economics minors are not required to take this course.

Mathematics major with economics concentration

This course may count as the econ elective.

Mathematics major and minor

ECON H304 counts as one of the 200-level math electives.

Statistics minor

ECON H304 counts towards statistics minor.

College graduation requirements:

Counts as one social science (SO) credit.

Satisfies the quantitative reasoning (QU) requirement.

***Frequency*:** Usually offered once every year.

Comparable courses offered at Bryn Mawr College

ECON B304: Econometrics is similar to ECON H304. Students majoring in economics at Haverford may take ECON B304 instead of ECON H304.

Mathematics H218: Probability. The course introduces formal probability theory. Topics included: sample spaces, combinatorics, conditional probability, independence, discrete and continuous random variables, functions of random variables, expected value and variance, the moment generating function, and some basic limit theorems. After the probability theorems, the following commonly used distributions in statistics are introduced: Binomial, Poisson, Normal, Exponential, and Uniform.

Requirements fulfilled

Mathematics major

For the mathematics major, this course counts as one 200-level elective.

Mathematics minor

For the mathematics minor, this course counts as one 200-level elective.

Econ major with math concentration or Math major with econ concentration

This course may count as one math elective.

Statistics minor

This course is required for the statistics minor.

College graduation requirements

Counts as one natural science (NA) credit.

Satisfies the quantitative reasoning (QU) requirement.

***Frequency*:** Once every year.

***Comparable courses offered at Bryn Mawr College*:** None.

Statistics/Mathematics H286: Applied Multivariate Statistical Analysis. The course includes methods for choosing, fitting, and evaluating multiple regression models. It introduces statistical theory in multiple regression analysis. A required computer lab, using R, is taught alongside this course.

Requirements fulfilled

Mathematics major

For the mathematics major, this course counts as one 200-level elective.

Mathematics minor

For the mathematics minor, this course counts as one 200-level elective.

Statistics minor

This course is required for the statistics minor.

College graduation requirements

Counts as one natural science (NA) credit.

Satisfies the quantitative reasoning (QU) requirement.

***Frequency*:** Once every other year.

***Comparable courses offered at Bryn Mawr College*:** None.

Statistics/Mathematics 328: Mathematical Statistics. Topics covered: estimation, hypothesis testing, chi-square distribution, t-distribution, F-distribution, goodness-of-fit test and regression. Additional topics may include analysis of variance. Emphasis on the theory underlying statistics.

Requirements fulfilled

Mathematics major

For the mathematics major, this course counts as one 300-level elective.

Mathematics minor

For the mathematics minor, this course counts as one 300-level elective.

Statistics minor

This course counts towards statistics minor

Econ major with math concentration or Math major with econ concentration

This course may count as one math elective.

College graduation requirements

Counts as one natural science (NA) credit.

Satisfies the quantitative reasoning (QU) requirement.

***Frequency*:** Once every other year.

Comparable courses offered at Bryn Mawr College: None.

Statistics/Mathematics H396: Advanced Topics in Probability and Statistics. Topics may vary from year to year.

Requirements fulfilled

Mathematics major

For the mathematics major, this course counts as one 300-level elective.

Mathematics minor

For the mathematics minor, this course counts as one 300-level elective.

Statistics minor

This course counts towards the statistics minor.

Econ major with math concentration or Math major with econ concentration

This course may count as one math elective.

College graduation requirements

Counts as one natural science (NA) credit.

Satisfies the quantitative reasoning (QU) requirement.

***Frequency*:** Once every other year.

Comparable courses offered at Bryn Mawr College: None.

GUIDELINES FOR CHOOSING WHICH STATISTICS COURSES TO TAKE

Guidelines that apply to all students

- Normally students are **not** allowed to take more than one of the following four courses: ECON H203, ECON H204, STAT/MATH H203, and SOCL H215. In special cases, and only with permission of the chair of the department offering the course, a student may take more than one of the above four courses.

  Although courses offered by different departments emphasize different statistical applications, the major topics covered in these courses are similar, and taking more than one of them would usually be redundant.

- For ECON H304 and STAT/MATH H286.
  Both ECON H304 and STAT/MATH H286 cover multiple regression analysis. ECON H304 emphasizes economic applications and STAT/MATH H286 emphasizes

the statistical theory behind the methods. ECON H304 counts as one of the 200-level math electives and also count towards the statistics minor.

- Most students planning to take any of the 200-level statistics courses described above **should not** take MATH H103.

  MATH H103 is an introductory statistics course designed for students with weak preparation in mathematics. The topics covered in MATH H103 overlap with any of the 200-level introductory statistics courses described above (ECON H203, ECON H204, STAT/MATH H203, PSYC H200, and SOCL H215). In most cases, students planning to take one of these 200-level introductory statistics courses should **not** take MATH H103. Occasionally, however, it may be advisable for a student with a weak mathematics background to take MATH H103 before taking a 200-level statistics course. Students considering this option should first consult with the corresponding departments.

Guidelines for students majoring or minoring in particular disciplines

Biology

Biology majors would benefit from taking either MATH H103 or STAT/MATH H203, depending upon their placement by the mathematics department. Students with minors in economics, psychology or sociology, or undertaking allied concentrations, could substitute discipline-specific statistics courses and are encouraged to discuss their interests with their major advisor or (for undeclared students) the chair of the biology department.

Economics

The standard introductory statistics course for students majoring or minoring in economics is either ECON H203 or ECON H204. Economics majors typically take one of these courses during their sophomore year, while economics minors usually take one of these courses in the sophomore or junior year. The courses cover largely the same material, but ECON 204 moves a little more quickly and uses calculus in the development of several topics. With permission of the economics department chair, it may be possible for economics majors and minors to substitute STAT/MATH H203 for ECON H203 or H204.

All economics majors are required to take ECON H304, economics minors may take this course as an elective. Economics majors usually take ECON H304 in their sophomore or junior year. This course builds on the foundation of statistical methods developed in ECON H203 or H204, and extends it to multiple regression and maximum likelihood estimation methods, with careful attention to issues that arise when fundamental assumptions are violated.

Advice to students considering majoring or minoring in economics

Students thinking of majoring or minoring in economics should **not** take MATH H103. If you major or minor in economics, you will study the material covered in that course when you take ECON H203 or ECON H204. In rare cases, it could be advisable for a student with weak preparation in math and quantitative methods to take MATH H103 before taking ECON H203 or H204. Any student considering doing so, however, should meet with the economics department chair to discuss whether it would be worthwhile in her or his case.

Students considering majoring or minoring in economics should also **not** take SOCL H215 (Quantitative Methods) because the overlap with ECON H203 and H204 is very large. For the same reason, economics majors and minor should not take STAT/MATH H203, unless they have received permission from the economics department chair to take that course in place of ECON H203 or H204.

Students majoring in economics who have completed ECON H304 and would like to take one or more additional courses on statistical methods are advised to consider MATH H218: Probability, STAT/Math H286: Applied Multivariate Statistical Analysis, and STAT/MATH H328: Mathematical Statistics.

Mathematics

Besides MATH H103, the mathematics department offers five other statistics courses. Two of them, STAT/MATH H203 and STAT/MATH H286, are applied statistics courses with emphasis on applying statistical methods to real life data. Those two courses are computer lab-based. The other three courses, STAT/MATH H218, STAT/MATH328 and STAT/MATH H396, are theoretical statistics courses, with emphasis on statistics theory.

Students who are interested in statistics and/or applied math should start with STAT/MATH H203. Then take STAT/MATH H286 after taking MATH H215 (Linear Algebra). It's better to take MATH H218 and STAT/MATH H328 in sophomore or junior year, after some vigorous math training. The department also strongly recommends students to learn programming skills. The recommended courses are: MATH H222: Scientific Computing and CMSC H105: Introduction to Computer Science.

Psychology

Students planning to major in psychology should take PSYC H200 (or PSYC B205 at Bryn Mawr). Students that have taken an advanced statistics course in other departments

should discuss their plans with the psychology department chair or psychology major advisor.

Sociology

Students planning to major in sociology should take SOCL H215.

Statistics Minor Requirements

The requirements for minoring in statistics are:

1. One of the following courses (Introduction to Statistics): Stat203/Econ204/Psyc200/Soci215;
2. Stat286 (Applied Multivariate Statistical Analysis);
3. Math218 (Probability);
4. Math215 (Linear Algebra);
5. Math121 or Math216 (Multivariable Calculus);
6. One of the following:
    - Stat328 (Mathematical Statistics)
    - Stat396 (Advanced Topics in Probability and Statistics)
    - Economics304 (Econometric)
    - Sociology320 (Advanced Quantitative Methods for Sociologists)

Notes:

1. *A math minor* can also be a statistics minor. If a student wants to be a math minor and a statistics minor, the following courses: Stat203, Econ204, Math218, Stat286, Stat328 and Stat396, cannot be counted to satisfy both the math minor and statistics minor.

2. *A math major* can also be a statistics minor. If a student wants to be a math major and a statistics minor, the following apply:
    - Stat203, Econ204 and Stat286 cannot be counted to satisfy both the math major and statistics minor requirement;
    - At most one of the following courses can be counted to satisfy both the math major and statistics minor: Math218, Stat328 and Stat396.

3. *Math majors with econ concentration*: If a math major wants to be an econ concentrator and a statistics minor, Math218, Stat286, Stat328 and Stat396 cannot be counted toward both the econ concentration and the statistics minor.

4. *Econ majors with math concentration*: If an economics major wants to be a math concentrator and also a stat minor, the following apply:
    - Math218, Stat286, Stat328 and Stat396, cannot be counted to satisfy both the stat minor and the math concentration requirement.
    - Econ304 cannot be counted toward statistics minor. (Econ304 is required by economics major.)