Statistics, BS

Learning Outcomes

Students will:

• be able to distinguish between observational studies and designed experiments and understand the issues related to the data collection method, including sampling bias, sampling error, sample size determination, statistical power, association versus causation, and the design and analysis of randomized experiments;

• use critical thinking skills to translate substantive questions into well-defined statistical problems and choose appropriate statistical methods and graphical summaries for a given problem;

• use computer software to manage data, carry out exploratory data analyses and computer simulations, produce numerical and graphical summaries of data, and apply basic statistical methodology;

• be able to clearly communicate study results to non-statisticians, and write accurate and meaningful reports that describe the statistical analyses and summarize important findings; and

• understand the mathematical tools underlying statistical methods, including distribution theory, uncertainty quantification via probability, estimation theory, and the probabilistic basis of formal statistical inference.

Requirements

The Bachelor of Science with a major in statistics requires a minimum of 120 s.h., including at least 47 s.h. of work for the major. Students must maintain a grade-point average of at least 2.00 in all courses for the major and in all UI courses for the major. They also must complete the College of Liberal Arts and Sciences GE CLAS Core.

Students who earn the major in statistics may not earn the major in data science.

Students complete 10 core courses that provide essential instruction in statistical methods, applications, and theory. In addition, they concentrate on an area of interest by completing four or five courses in one of the major's three emphasis tracks: statistics in business, industry, government, and research; statistical computing and data science; or mathematical statistics.

The BS with a major in statistics requires the following coursework.

Core Courses


Course # Title Hours

Computer Science

This course:
CS:1210 Computer Science I: Fundamentals 4

Mathematics

All of these:
MATH:1850 Calculus I 4
MATH:1860 Calculus II 4
MATH:2700 Introduction to Linear Algebra 4
MATH:2850 Calculus III 4

Statistics

All of these:
STAT:2010 Statistical Methods and Computing 3
STAT:3100/IGPI:3100 Introduction to Mathematical Statistics I 3
STAT:3101/IGPI:3101 Introduction to Mathematical Statistics II 3
STAT:3210 Experimental Design and Analysis 3

Emphasis Track

Choose four or five courses from one of the following tracks to gain the skillset suitable for a particular career.

• Statistics in Business, Industry, Government and Research Track (p. 1)
• Statistical Computing and Data Science Track (p. 2)
• Mathematical Statistics Track (p. 2)

Statistics in Business, Industry, Government and Research Track

The statistics in business, industry, government and research track emphasizes statistical applications and data analysis. It is appropriate for students interested in careers as applied statisticians.

Course # Title Hours

This course:
STAT:5810/BIOS:5310/IGPI:5310 Research Data Management 3

Three of these:
STAT:3620/CEE:3142/ISE:3600 Quality Control 3
STAT:4520/IGPI:4522/PSQF:4520 Bayesian Statistics 3
STAT:4540/BAIS:4540/DATA:4540/IGPI:4540 Statistical Learning 3
STAT:4580/DATA:4580/IGPI:4580 Data Visualization and Data Technologies 3
Statistics, BS

Computing in Statistics 3

STAT:5400 /
DATA:5400 /
IGPI:5400

Statistical Consulting 3

STAT:6220

Environmental and Spatial Statistics 3

STAT:6530 /
IGPI:6530

Introductory Longitudinal Data Analysis 3

STAT:6550 /
BIOS:6310 /
IGPI:6310

Applied Time Series Analysis 3

STAT:6560

Statistical Consulting 3

STAT:6560

Introduction to Numerical Methods 3

BIOS:5130 /
IGPI:5130

Applied Categorical Data Analysis 3

CS:3700 /
MATH:3800

Introduction to Numerical Methods 3

DATA:4750

Probabilistic Statistical Learning 3

MATH:4820 /
CS:4720

Optimization Techniques 3

MATH:4840

Mathematics of Machine Learning 3

Mathematical Statistics Track

The mathematical statistics track provides a solid foundation in statistical theory and applications. It requires additional coursework in mathematics and is good preparation for graduate study in statistics.

Students who use STAT:4100/IGPI:4100 Mathematical Statistics I and STAT:4101/IGPI:4101 Mathematical Statistics II to satisfy the core requirements may not use those courses to satisfy the track requirement.

Course #       Title                     Hours
This course:
MATH:3770    Fundamental Properties of Spaces and Functions I 4

9 s.h. from these:
STAT:4100-
STAT:4101    Mathematical Statistics I-II (same as IGPI:4100-
IGPI:4101) 6

STAT:4520/
IGPI:4522/
PSQF:4520    Bayesian Statistics 3

STAT:4540/
BAIS:4540/
DATA:4540/
IGPI:4540    Statistical Learning 3

STAT:4560    Statistics for Risk Modeling I 3

STAT:5120    Mathematical Methods for Statistics 3

STAT:6220    Statistical Consulting 3

STAT:6300-
STAT:6301    Probability and Stochastic Processes I-II 6

STAT:6530/
IGPI:6530    Environmental and Spatial Statistics 3

STAT:6560    Applied Time Series Analysis 3

CS:3700/
MATH:3800    Introduction to Numerical Methods 3

DATA:4750    Probabilistic Statistical Learning 3

MATH:4820/
CS:4720    Optimization Techniques 3

MATH:4840    Mathematics of Machine Learning 3

Combined Programs

BS/MS in Statistics

The combined Bachelor of Science/Master of Science in statistics is for eligible students who seek to complete both the BS and the MS at the University of Iowa in five years. Students in the combined program must complete all requirements for each degree. A traditional MS in statistics requires completion of 32 s.h. of graduate-level coursework. The BS/MS program permits students to count 12 s.h. of credit (four courses) toward the requirements for both degrees.

To complete the MS, an additional 20 s.h. of coursework is
required. The four courses that count toward both degrees must be taken during the fourth year of undergraduate study, after admission to the combined program, and must satisfy degree requirements of both the BS and the MS in statistics.

**BS/MPH (Biostatistics Subprogram)**

Students majoring in statistics who are interested in earning a Master of Public Health degree with a biostatistics subprogram may apply to the combined BS/MPH program offered by the College of Liberal Arts and Sciences and the College of Public Health. The program permits students to count 15 s.h. of credit toward the requirements for both degrees, enabling them to begin the study of public health before they complete the bachelor's degree. For information about the public health program, see the Master of Public Health, MPH (biostatistics subprogram) section of the catalog.

**BS/MS in Biostatistics**

The combined BS in statistics/MS in biostatistics enables Bachelor of Science students majoring in statistics to begin work toward the MS while completing the bachelor's degree. Students admitted to the program may count 12 s.h. of credit toward both the BS and the MS degree requirements. Offered by the Graduate College, the College of Liberal Arts and Sciences, and the College of Public Health; see the MS in biostatistics in the catalog.

**Honors**

**Honors in the Major**

Students majoring in statistics have the opportunity to graduate with honors in the major. Departmental honors students must maintain a grade-point average (GPA) of at least 3.67 in their major and a cumulative University of Iowa GPA of at least 3.33.

To graduate with honors in the statistics major, students must complete an honors project or a suitable alternative. Statistics honors students should consult with the statistics undergraduate advisor.

**University of Iowa Honors Program**

In addition to honors in the major, students have opportunities for honors study and activities through membership in the University of Iowa Honors Program. Visit Honors at Iowa to learn about the university's honors program.

Membership in the UI Honors Program is not required to earn honors in the statistics major.

**Career Advancement**

Statistics and probability are vital to many fields, so the demand for well-trained statisticians is strong. Statisticians work in medicine, engineering, law, public policy making, marketing, manufacturing, engineering, agriculture, varied social and natural sciences, and numerous other areas.

When students graduate, they will be prepared to fill entry-level positions as statisticians or go on to graduate school. An advisor assists students in locating internship opportunities as well as the best-fitting graduate programs.

To learn more about job opportunities, see ASA JobWeb on the American Statistical Association website.

The Pomerantz Career Center offers multiple resources to help students find internships and jobs.

### Four-Year Graduation Plan

The following checkpoints list the minimum requirements students must complete by certain semesters in order to stay on the university’s Four-Year Graduation Plan. Courses in the major are those required to complete the major; they may be offered by departments other than the major department.

Much of the coursework in statistics is sequential, so students must begin requirements for the major as soon as possible. Individual study plans must be made carefully. Students who first enroll for a spring semester must consult their advisor to confirm a four-year plan.

Courses must be taken in sequence, so students must begin work early.

**Before the fifth semester begins:** at least four courses in the major, including MATH:1850 Calculus I, MATH:1860 Calculus II, and STAT:2010 Statistical Methods and Computing.

**Before the seventh semester begins:** seven or eight courses in the major and at least 90 s.h. earned toward the degree.

**Before the eighth semester begins:** nine or ten courses in the major.

**During the eighth semester:** enrollment in all remaining coursework in the major, all remaining GE CLAS Core courses, and a sufficient number of semester hours to graduate.

### Sample Plans of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

**Statistics, BS**

- Statistics in Business, Industry, Government and Research Track [p. 3]
- Statistical Computing and Data Science Track [p. 4]
- Mathematical Statistics Track [p. 5]

### Statistics in Business, Industry, Government and Research Track

<table>
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<td>First Year</td>
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<td>Fall</td>
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<tr>
<td>CS:1210</td>
<td>Computer Science I: Fundamentals</td>
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<td>MATH:1850</td>
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<td>ENGL:1200 or RHET:1030</td>
<td>The Interpretation of Literature or Rhetoric</td>
<td>3 - 4</td>
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GE CLAS Core: World Languages First Level 4 - 5
Proficiency or elective course d
CSI:1600 Success at Iowa 2

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<th>Hours</th>
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Spring
STAT:2010 Statistical Methods and Computing 3
MATH:1860 Calculus II 4
MATH:2700 Introduction to Linear Algebra 4
GE CLAS Core: Natural Sciences with Lab e 4
GE CLAS Core: World Languages Second Level 4 - 5
Proficiency or elective course d

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Second Year
Fall
STAT:3100 Introduction to Mathematical Statistics I f 3
STAT:3200 Applied Linear Regression 3
GE CLAS Core: Natural Sciences with Lab e 4
GE CLAS Core: World Languages Third Level 4 - 5
Proficiency or elective course d

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<th>Hours</th>
<th>14-15</th>
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</table>

Third Year
Fall
STAT:5810 Research Data Management h 3
MATH:2850 Calculus III 4
GE CLAS Core: International and Global Issues e 3
GE CLAS Core: Natural Sciences without Lab e 3
Elective course i 3

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Spring
STAT:3210 Experimental Design and Analysis g 3
GE CLAS Core: Literary, Visual, and Performing Arts e 3
GE CLAS Core: Social Sciences e 3
Elective course i 3

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Fourth Year
Fall
Major: upper-level statistics course h 3
Elective course i 3
Elective course i 3
Elective course i 3
Elective course i 3

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<th>Hours</th>
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Spring
Major: upper-level statistics course h 3
GE CLAS Core: Values and Culture e 3
Elective course i 3

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<tr>
<th>Hours</th>
<th>15</th>
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Elective course i 3
Elective course i 3
Elective course i 3

Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall) j

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<th>Hours</th>
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Total Hours 123-129

a Sustainability must be completed by choosing a course that has been approved for Sustainability AND for one of these General Education areas: Natural Sciences; Quantitative and Formal Reasoning; Social Sciences; Historical Perspectives; International and Global Issues; Literary, Visual, and Performing Arts; or Values and Culture.
b Enrollment in this course requires completion of a placement exam.
c Enrollment in math courses requires completion of a placement exam.
d Students who have completed four years of a single language in high school have satisfied the GE CLAS Core World Languages requirement. Enrollment in world languages courses requires a placement exam, unless enrolling in a first-semester-level course.
e GE CLAS Core courses may be completed in any order unless used as a prerequisite for another course. Students should consult with an advisor about the best sequencing of courses.
f Typically this course is offered in fall semesters only. Check MyUI for course availability since offerings are subject to change.
g Typically this course is offered in spring semesters only. Check MyUI for course availability since offerings are subject to change.
h Students must complete STAT:5810 and 9 s.h. from approved courses for the Statistics in Business, Industry, Government and Research emphasis track.
i Students may use elective courses to earn credit towards the total s.h. required for graduation or to complete a double major, minors, or certificates.
j Please see Academic Calendar, Office of the Registrar website for current degree application deadlines. Students should apply for a degree for the session in which all requirements will be met. For any questions on appropriate timing, contact your academic advisor or Graduation Services.

Statistical Computing and Data Science Track

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Academic Career

GE CLAS Core: Sustainability a

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First Year
Fall
CS:1210 Computer Science I: Fundamentals b 4
MATH:1850 Calculus I c 4
ENGL:1200 The Interpretation of Literature or RHET:1030 or Rhetoric 3 - 4
GE CLAS Core: World Languages First Level 4 - 5
Proficiency or elective course d

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GE CLAS Core: Sustainability a

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Sustainability must be completed by choosing a course that has been approved for Sustainability AND for one of these General Education areas: Natural Sciences; Quantitative and Formal Reasoning; Social Sciences; Historical Perspectives; International and Global Issues; Literary, Visual, and Performing Arts; or Values and Culture.

Enrollment in this course requires completion of a placement exam.

Enrollment in math courses requires completion of a placement exam.

Students who have completed four years of a single language in high school have satisfied the GE CLAS Core World Languages requirement. Enrollment in world languages courses requires a placement exam, unless enrolling in a first-semester-level course.

GE CLAS Core courses may be completed in any order unless used as a prerequisite for another course. Students should consult with an advisor about the best sequencing of courses.

Typically this course is offered in fall semesters only. Check MyUI for course availability since offerings are subject to change.

Typically this course is offered in spring semesters only. Check MyUI for course availability since offerings are subject to change.

Students must complete STAT:5810 and 9 s.h. from approved courses for the Statistics in Business, Industry, Government and Research emphasis track.

Students may use elective courses to earn credit towards the total s.h. required for graduation or to complete a double major, minors, or certificates.

Please see Academic Calendar, Office of the Registrar website for current degree application deadlines. Students should apply for a degree for the session in which all requirements will be met. For any questions on appropriate timing, contact your academic advisor or Graduation Services.
CSI:1600  Success at Iowa  2

**Spring**

STAT:2010  Statistical Methods and Computing  3
MATH:1860  Calculus II  4
MATH:2700  Introduction to Linear Algebra  4
GE CLAS Core: Diversity and Inclusion  3
GE CLAS Core: World Languages Second Level  4 - 5
Proficiency or elective course  

**Hours**  17-19

**Second Year**

**Fall**

STAT:3200  Applied Linear Regression  3
CS:2210  Discrete Structures  3
GE CLAS Core: Historical Perspectives  3
GE CLAS Core: Natural Sciences without Lab  3
GE CLAS Core: World Languages Third Level  4 - 5
Proficiency or elective course  

**Hours**  16-17

**Spring**

CS:2230  Computer Science II: Data Structures  4
RHET:1030 or ENGL:1200  Rhetoric or The Interpretation of Literature  3 - 4
GE CLAS Core: Natural Sciences with Lab  4
GE CLAS Core: World Languages Fourth Level  4 - 5
Proficiency or elective course  

**Hours**  15-17

**Third Year**

**Fall**

STAT:3100  Introduction to Mathematical Statistics  3
MATH:2850  Calculus III  4
GE CLAS Core: International and Global Issues  3
GE CLAS Core: Social Sciences  3
Elective course  3

**Hours**  16

**Spring**

STAT:3101  Introduction to Mathematical Statistics II  3
STAT:3210  Experimental Design and Analysis  3
GE CLAS Core: Literary, Visual, and Performing Arts  3
Elective course  3
Elective course  3

**Hours**  15

**Fourth Year**

**Fall**

STAT:5810  Research Data Management  3
Major: upper-level statistics course  3
Elective course  3
Elective course  3
Elective course  3

**Hours**  15

**Spring**

Major: upper-level statistics course  3
GE CLAS Core: Values and Culture  3

Elective course  3
Elective course  3
Elective course  3

Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall)  

**Hours**  15

**Total Hours**  127-133

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**Mathematical Statistics Track**

**Course**

**Title**

**Hours**

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**First Year**

**Fall**

CS:1210  Computer Science I: Fundamentals  4
MATH:1850  Calculus I  4
ENGL:1200 or RHET:1030  The Interpretation of Literature or Rhetoric  3 - 4
GE CLAS Core: World Languages First Level  4 - 5
Proficiency or elective course  3
CSI:1600  Success at Iowa  2

**Hours**  17-19

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**Academic Career**

**Title**

**Hours**

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**Any Semester**

GE CLAS Core: Sustainability  3

**Hours**  0

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**Second Year**

**Fall**

Major: upper-level statistics course  3

**Hours**  17-19

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**Third Year**

**Fall**

Major: upper-level statistics course  3

**Hours**  17-19

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**Fourth Year**

**Fall**

Major: upper-level statistics course  3

**Hours**  17-19

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**Any Semester**

GE CLAS Core: Sustainability  3

**Hours**  0
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Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall)

- **Total Hours**: 124-130

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**Notes**:

- a Sustainability must be completed by choosing a course that has been approved for Sustainability AND for one of these General Education areas: Natural Sciences; Quantitative and Formal Reasoning; Social Sciences; Historical Perspectives; International and Global Issues; Literary, Visual, and Performing Arts; or Values and Culture.
- b Enrollment in this course requires completion of a placement exam.
- c Enrollment in math courses requires completion of a placement exam.
- d Students who have completed four years of a single language in high school have satisfied the GE CLAS Core World Languages requirement. Enrollment in world languages courses requires a placement exam, unless enrolling in a first-semester-level course.
- e GE CLAS Core courses may be completed in any order unless used as a prerequisite for another course. Students should consult with an advisor about the best sequencing of courses.
- f Typically this course is offered in fall semesters only. Check MyUI for course availability since offerings are subject to change.
- g Typically this course is offered in spring semesters only. Check MyUI for course availability since offerings are subject to change.
- h Students must complete MATH:3770 and 9 s.h. from approved courses for the Mathematical Statistics emphasis track.
- i Students who use STAT:4100 and STAT:4101 to satisfy the core requirements may not use those courses to satisfy the track requirement. Typically STAT:4100 is offered in fall semesters only and STAT:4101 is offered in spring only. Check MyUI for course availability since offerings are subject to change.
- j Students may use elective courses to earn credit towards the total s.h. required for graduation or to complete a double major, minors, or certificates.
- k Please see Academic Calendar, Office of the Registrar website for current degree application deadlines. Students should apply for a degree for the session in which all requirements will be met. For any questions on appropriate timing, contact your academic advisor or Graduation Services.