Statistics, PhD

Requirements

The Doctor of Philosophy program in statistics requires a minimum of 76 s.h. of graduate credit, including work completed for the MS.

The Graduate College requires a minimum grade-point average (GPA) of 3.00 to graduate with a PhD; however, the Department of Statistics and Actuarial Science requires a higher GPA of at least 3.40 to earn the PhD in statistics. This includes all courses used to meet degree requirements plus additional courses that are relevant to a student's program.

PhD students complete required coursework, including four courses in one of four concentration areas: actuarial science/financial mathematics, biostatistics, data science, or probability/mathematical statistics (see the section titled "Concentration Areas" for area descriptions and course lists). They may take coursework or seminars in other departments to relate an area of specialization to other fields of knowledge, to acquire the ability to use electronic digital computing equipment, or to learn non-English language skills necessary for reading scientific journals and communicating with scholars in other languages.

PhD Qualifying Procedure

Students enter the PhD program in one of two tracks.

Statistics

After passing the MS final examination, a student who will choose either biostatistics, probability/mathematical statistics, or data science as the selected concentration area can request, by notifying the director of graduate studies, to go through the PhD qualifying procedure. Upon this request, the faculty evaluates the student's body of work, which includes the MS final examination in statistics, coursework, and evidence for research potential. Usually, students need to achieve an A in at least one course numbered 7000 or above, complete at least 1 s.h. of STAT:6990 Readings in Statistics, be enrolled in a second semester of STAT:6990, and identify a faculty member who agrees to serve as the student's PhD advisor to be admitted. This evaluation and assessment results in one of three decisions: the student is officially admitted into the PhD program; the student must reapply to go through the PhD qualifying procedure after accumulating a larger body of work for evaluation; or the student is not admitted into the PhD program.

In exceptional cases, a student may petition to go through the PhD qualifying procedure early, or be admitted to the PhD program directly. However, passing the MS final exam is required before any student can take the PhD comprehensive exam (see the "Final Exam").

Actuarial Science

After successfully passing the MS final examination in actuarial science (in exceptional cases, a student may petition to go through the PhD qualifying procedure early), a student who will choose actuarial science/financial mathematics as the selected concentration area, can request, by notifying the director of graduate studies, to go through the PhD qualifying procedure. Upon this request, the faculty evaluate the student's body of work and assess the student's potential for research. The body of work will include the MS final examination in actuarial science, professional examinations passed, and coursework. This evaluation and assessment results in one of two decisions: the student is officially admitted into the PhD program in the actuarial science/financial mathematics concentration area, or the student is not admitted into the PhD program.

Students complete the program by passing the PhD final (comprehensive) examination and writing and defending a dissertation. Students usually complete the program three years after earning the MS.

A plan of study that does not conform to the requirements described as follows but is of high quality may be approved by the director of graduate studies.

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

Required Coursework

Actuarial Science/Financial Mathematics Concentration Area

Actuarial science/financial mathematics emphasizes the theory of actuarial science, finance, and risk management. It is excellent preparation for academic positions in universities that offer actuarial science programs and for positions in the insurance, pension, and financial industries.

<table>
<thead>
<tr>
<th>Course #</th>
<th>Title</th>
<th>Hours</th>
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<tr>
<td>STAT:4100-</td>
<td>Mathematical Statistics I-II (same as IGPI:4100-IGPI:4101)</td>
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<tr>
<td>STAT:4101</td>
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<tr>
<td>ACTS:4130</td>
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<td>ACTS:4180</td>
<td>Life Contingencies I</td>
<td>3</td>
</tr>
<tr>
<td>ACTS:4280</td>
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<td>STAT:6300</td>
<td>Probability and Stochastic Processes I</td>
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</tr>
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<tr>
<td>STAT:7400/</td>
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<td>Reading Research</td>
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<td>STAT:4560</td>
<td>Statistics for Risk Modeling I</td>
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<td>STAT:4561</td>
<td>Statistics for Risk Modeling II</td>
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<td>STAT:7560</td>
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<tr>
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<tr>
<td>STAT:7190</td>
<td>Insurance Mathematics</td>
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<tr>
<td>STAT:7290</td>
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<tr>
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<tr>
<td>STAT:7490</td>
<td>Credit Risk Management</td>
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</tr>
<tr>
<td>STAT:7590</td>
<td>Risk Management</td>
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<tr>
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<tr>
<td>STAT:8090</td>
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</table>

**Notes:**
- Students must complete a minimum of 76 s.h. of graduate credit.
- The final examination in actuarial science is required before completing the PhD.
- Students must pass the PhD comprehensive examination and write and defend a dissertation to complete the program.
- Students usually complete the program in three years after earning the MS.
- A plan of study that does not conform to the requirements described as follows but is of high quality may be approved by the director of graduate studies.
- Students may petition to go through the PhD qualifying procedure early, or be admitted to the PhD program directly.
- Students must pass the MS final examination in actuarial science, professional examinations, and coursework to be officially admitted into the PhD program.
ACTS:6200/ DATA:6200/ STAT:6200  Predictive Analytics  3
ACTS:7730  Advanced Topics in Actuarial Science/Financial Mathematics  3
FIN:7110  Finance Theory I  3
FIN:7130  Finance Theory II  3

Biostatistics Concentration Area

Biostatistics emphasizes exposure to various biostatistical methods, such as survival analysis, categorical data analysis, and longitudinal data analysis. It prepares students for consulting and other positions in industry.

<table>
<thead>
<tr>
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<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
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<td>ALPHA Seminar</td>
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<td>Applied Statistics I</td>
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</tr>
<tr>
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<td>Consulting and Communication with Data</td>
<td>3</td>
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<tr>
<td>STAT:6300</td>
<td>Probability and Stochastic Processes I</td>
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<td>STAT:7101</td>
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<td>STAT:7200</td>
<td>Linear Models</td>
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<td>Advanced Probability</td>
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<td>Reading Research</td>
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<td>Environmental and Spatial Statistics</td>
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<td>STAT:7510/ BIOS:7410</td>
<td>Analysis of Categorical Data</td>
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<td>STAT:7570/ BIOS:7210/ IGPI:7210</td>
<td>Survival Data Analysis</td>
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<td>BIOS:6650/ EPID:6655/ IGPI:6650</td>
<td>Causal Inference</td>
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<tr>
<td>BIOS:6720</td>
<td>Statistical Machine Learning for Biomedical and Public Health Data</td>
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<tr>
<td>BIOS:7240</td>
<td>High-Dimensional Data Analysis</td>
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<tr>
<td>BIOS:7310/ IGPI:7310</td>
<td>Longitudinal Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>DATA:7350</td>
<td>High-Dimensional Probability for Data Science</td>
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</tbody>
</table>

Data Science Concentration Area

The data science track emphasizes the theory, methodology, and application of techniques for working with and learning from data. This concentration area prepares students to develop new methods for visualizing and modeling data, managing reproducible data analysis workflows, and collaborating with scientists and other data stakeholders. It is excellent preparation for students interested in academic, industrial, or government positions that involve data visualization, modeling, and analysis.

<table>
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<th>Hours</th>
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</thead>
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<tr>
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<tr>
<td>STAT:5101</td>
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<tr>
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<td>Consulting and Communication with Data</td>
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<td>STAT:7200</td>
<td>Linear Models</td>
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<tr>
<td>STAT:7500/ BAIS:7500</td>
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<td>Statistical Learning</td>
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<td>STAT:4580/ DATA:4580/ IGPI:4580</td>
<td>Data Visualization and Data Technologies</td>
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<td>Probabilistic Statistical Learning</td>
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<td>Predictive Analytics</td>
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</table>
theory. trained statisticians with a strong understanding of statistical and industrial or government positions that require broadly preparation for academic positions in mathematical statistics produce well-rounded, knowledgeable scholars. It is excellent statistics. Its focus on breadth and depth is intended to foundation in techniques and underpinnings of mathematical

Concentration Area
Probability/Mathematical Statistics

Probability/mathematical statistics emphasizes a broad, solid foundation in techniques and underpinnings of mathematical statistics. Its focus on breadth and depth is intended to produce well-rounded, knowledgeable scholars. It is excellent preparation for academic positions in mathematical statistics and industrial or government positions that require broadly trained statisticians with a strong understanding of statistical theory.

Course #        Title                                      Hours
All of these from the MS in statistics program:
STAT:5090        ALPHA Seminar                               1
STAT:5100        Statistical Inference I                        3
STAT:5101        Statistical Inference II                       3
STAT:5200/       Applied Statistics I                         4
IGPI:5199
STAT:5201        Applied Statistics II                          3
STAT:5400/       Computing in Statistics                      3
DATA:5400/      IGPI:5400
STAT:6220/       Consulting and Communication with Data       3
DATA:6220
STAT:6300        Probability and Stochastic Processes I        3
STAT:6990        Readings in Statistics (two consecutive enrollments) 2
All of these:
STAT:5120        Mathematical Methods for Statistics            3
STAT:7100        Advanced Inference I                           3
STAT:7101        Advanced Inference II                          3
STAT:7200        Linear Models                                  4
STAT:7300        Advanced Probability                           3
STAT:7400/       Computer Intensive Statistics                3
DATA:7400/      IGPI:7400
STAT:7990        Reading Research                              18
Seminars chosen from STAT:7190, STAT:7290, and STAT:7390 2
At least four of these, with at least one numbered 7000 or above:
STAT:6301        Probability and Stochastic Processes II           3
STAT:7500/       Statistical Machine Learning                   3
BAIS:7500
STAT:7520        Bayesian Analysis                                3
STAT:7560        Time Series Analysis                            3
BIOS:6650/       Causal Inference                                3
EPID:6655/      IGPI:6650
BIOS:7240        High-Dimensional Data Analysis                  3
DATA:7350        High-Dimensional Probability for Data Science    3

Committee
After admission to the PhD program and before taking the PhD comprehensive exam, the candidate chooses a committee of at least four members, which is approved by the advisor. At least three of the faculty members must be University of Iowa tenure-track faculty members. At least two of the faculty members must be from the major department (defined as faculty members who hold any appointment in the major department), and University of Iowa tenure-track faculty members.

The department may request the Graduate College dean’s permission to replace one of the four committee members with a recognized scholar of professorial rank from another academic institution.

PhD Comprehensive Exam (Prospectus)
After passing the MS final exam and within 12–18 months (12 months is ideal, 18 months is acceptable) of admittance to the PhD program, the candidate should present a written and oral prospectus to the committee, which serves as the PhD comprehensive exam. The prospectus describes the problems the student is considering for the thesis, an extensive review of relevant background materials, open problems of interest and ideas for solving problems, and any preliminary results. Failure to successfully complete the prospectus within 18 months of admittance to the PhD program will jeopardize the continuation of a student’s financial support.

Each PhD committee member will sign the examination report as satisfactory, reservations, or unsatisfactory. A vote of "Reservations" should only be used when a faculty member feels that the deficiencies displayed by the student were modes and can be readily rectified. In the event of a report with two or more votes of "Reservations," the committee’s requirements of the student to correct the deficiencies must be recorded and submitted to the Graduate College with the examination report form. The statement must specify the time allotted for completion of the aforementioned actions. For example, if additional coursework is required, a list of suitable courses must be presented. If the candidate must rewrite their research prospectus, the deficient areas must be identified. If the candidate satisfies the required actions within the specified period of time, the comprehensive examination will be recorded as "Satisfactory" as of that date. If the actions are not satisfied on time, or if the actions are not of sufficient quality, the comprehensive examination will be recorded as "Unsatisfactory" as of that date. The candidate will not be admitted to the PhD final examination of the dissertation until a grade of "Satisfactory" has been recorded for the comprehensive exam.

In the case of a report of unsatisfactory on a comprehensive examination, the committee may grant the candidate permission to attempt a reexamination no sooner than four months after the first examination. The examination may be repeated only once, at the option of the department.
PhD Final Exam (Dissertation Defense)

Students should plan to defend their dissertation within 24–30 months (24 months is ideal, 30 months is acceptable) of passing the PhD comprehensive exam. Failure to successfully defend the dissertation within 30 months of passing the PhD comprehensive exam or within 5 years of starting the graduate program at the University of Iowa, whichever comes first, will jeopardize the continuation of a student's financial support.