Statistics, Ph.D.

Requirements

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

The Graduate College requires a minimum g.p.a. of 3.00 to graduate with a Ph.D. degree; however, the Department of Statistics and Actuarial Science requires a higher g.p.a. of at least 3.40 to earn the Ph.D. in statistics. This includes all courses used to meet degree requirements plus additional courses that are relevant to a student's program.

Ph.D. 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 "Concentration Areas" below 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.

Ph.D. Qualifying Procedure

Students enter the Ph.D. program in one of two tracks.

Statistics

After successfully passing both the M.S. final examination in statistics and the creative component (in exceptional cases, a student may petition to go through the Ph.D. qualifying procedure early), a student who will choose either biostatistics, data science, or probability/mathematical statistics as the selected concentration area, can request, by notifying the director of graduate studies, to go through the Ph.D. 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 M.S. final examination in statistics, the creative component, and coursework. This evaluation and assessment results in one of three decisions—the student is officially admitted into the Ph.D. qualifying procedure after accumulating a larger body of work for evaluation; or the student is not admitted into the Ph.D. program; the student must reapply to go through the Ph.D. qualifying procedure after accumulating a larger body of work for evaluation; or the student is not admitted into the Ph.D. program.

Actuarial Science

After successfully passing the M.S. final examination in actuarial science (in exceptional cases, a student may petition to go through the Ph.D. 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 Ph.D. 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 M.S. final examination in actuarial science, professional examinations passed, and course work. This evaluation and assessment results in one of two decisions—the student is officially admitted into the Ph.D. program in the actuarial science/financial mathematics concentration area, or the student is not admitted into the Ph.D. program.

Students complete the program by passing the Ph.D. final (comprehensive) examination and writing and defending a dissertation. Students usually complete the program three years after earning the M.S. degree.

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

The Ph.D. 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>Code</th>
<th>Title</th>
<th>Hours</th>
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<tr>
<td>STAT:4100-4101</td>
<td>Mathematical Statistics I-II (same as IGPI:4100-4101)</td>
<td>6</td>
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<tr>
<td>STAT:5100-5101</td>
<td>Statistical Inference I-II (for well-prepared students)</td>
<td>6</td>
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<td>All of these from the M.S. in actuarial science program:</td>
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<td>ACTS:4130</td>
<td>Quantitative Methods for Actuaries</td>
<td>3</td>
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<td>ACTS:4180</td>
<td>Life Contingencies I</td>
<td>3</td>
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<td>ACTS:4280</td>
<td>Life Contingencies II</td>
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<tr>
<td>STAT:6300</td>
<td>Probability and Stochastic Processes I</td>
<td>3</td>
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<tr>
<td>And all of these:</td>
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<tr>
<td>DATA:7350</td>
<td>High-Dimensional Probability for Data Science</td>
<td>3</td>
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<td>STAT:5120</td>
<td>Mathematical Methods for Statistics</td>
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<td>STAT:7100</td>
<td>Advanced Inference I</td>
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<tr>
<td>STAT:7101</td>
<td>Advanced Inference II</td>
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<tr>
<td>STAT:7200</td>
<td>Linear Models</td>
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<tr>
<td>STAT:7300</td>
<td>Foundations of Probability I</td>
<td>3</td>
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<tr>
<td>STAT:7400/IGPI:7400</td>
<td>Computer Intensive Statistics</td>
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<td>STAT:7500/BAIS:7500</td>
<td>Statistical Machine Learning</td>
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<td>STAT:7990</td>
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<td>At least four of these, with at least one numbered 7000 or above:</td>
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<tr>
<td>ACTS:6200</td>
<td>Predictive Analytics</td>
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<td>ACTS:7730</td>
<td>Advanced Topics in Actuarial Science/Financial Mathematics</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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</tr>
<tr>
<td>STAT:6301</td>
<td>Probability and Stochastic Processes II</td>
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</tbody>
</table>
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.

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.
Probability/Mathematical Statistics Concentration Area

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.

All of these from the M.S. in statistics program:
- STAT:5090 ALPHA Seminar 1
- STAT:5100 Statistical Inference I 3
- STAT:5101 Statistical Inference II 3
- STAT:5200/IGPI:5199 Applied Statistics I 4
- STAT:5201 Applied Statistics II 3
- STAT:5400/IGPI:5400 Computing in Statistics 3
- STAT:6220 Statistical Consulting 3
- STAT:6300 Probability and Stochastic Processes I 3
- STAT:6990 Readings in Statistics (two consecutive enrollments) 2

And 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 Foundations of Probability I 3
- STAT:7400/IGPI:7400 Computer Intensive Statistics 3
- STAT:7990 Reading Research 18

Seminars chosen from STAT:7190, STAT:7290, STAT:7390

At least four of these, with at least one numbered 7000 or above:
- DATA:7350 High-Dimensional Probability for Data Science 3
- STAT:6301 Probability and Stochastic Processes II 3
- STAT:7301 Foundations of Probability II 3
- STAT:7500/BAIS:7500 Statistical Machine Learning 3
- STAT:7520 Bayesian Analysis 3
- STAT:7560 Time Series Analysis 3
- BIOS:6650/IGPI:6650 Causal Inference 3
- BIOS:7240 High-Dimensional Data Analysis 3

Final Examination

Students typically take the Ph.D. final (comprehensive) examination at the beginning of the third year of graduate study, during the week before fall classes begin. Students who do not succeed the first time they take the exam may repeat it once. Ordinarily, this second opportunity to pass the exam will occur one year later, during the week before fall classes begin. However, a student who performs well on one area of the exam but not the other may, in consultation with their advisor and the director of graduate studies, petition the department to move up their second opportunity to the week before the next spring semester's classes begin. The department's decision on whether to grant this petition will take into account any extenuating circumstances.

The comprehensive examination consists of a written core examination and an oral examination in two of the following four areas:

- statistical inference (topics in STAT:5100 Statistical Inference I, STAT:5101 Statistical Inference II, and STAT:7100 Advanced Inference I);
- linear models (topics in STAT:7200 Linear Models);
- probability (topics in STAT:6300 Probability and Stochastic Processes I and STAT:7300 Foundations of Probability I);

Students in the actuarial science/financial mathematics concentration area have the option of taking only one of the four examinations listed above and an actuarial science/financial mathematics examination designed by their advisor and approved by the director of graduate studies.

Committee

Upon passing the Ph.D. final examination, 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.

Prospectus

Within 18 months of passing the Ph.D. final exam, the candidate should present a written and oral prospectus to the committee. The prospectus describes the problems the student is considering for the thesis, relevant background material, ideas for solving the problems, and any preliminary results. Failure to successfully complete the prospectus within 24 months of passing the Ph.D. final exam will jeopardize the continuation of a student’s financial support.