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 course work, including four courses in one of four concentration areas: biostatistics, probability/mathematical statistics, statistical computing, or actuarial science/financial mathematics (see "Concentration Areas" below for area descriptions and course lists). They may take course work 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, probability/mathematical statistics, or statistical computing 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 evaluates the student's body of work and assesses the student's potential for research. The body of work will include the M.S. final examination in statistics, the creative component, and course work. This evaluation and assessment results in one of three decisions—the student is officially 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 evaluates the student's body of work and assesses 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 program that does not conform to the requirements described below but is of high quality may be approved by the department chair.

Each semester a student registers for at least 6 s.h., that student must include at least one 2 s.h. course offered by the department, excluding STAT:6990 Readings in Statistics and STAT:7990 Reading Research.

The Ph.D. with a major in statistics requires the following work.

Statistics Courses

Biostatistics, Probability/Mathematical Statistics, or Statistical Computing Concentration Area

Students in the biostatistics, probability/mathematical statistics, or statistical computing concentration area must complete the following core courses from the M.S. in statistics program.

<table>
<thead>
<tr>
<th>All of these:</th>
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<tbody>
<tr>
<td>STAT:5090</td>
<td>ALPHA Seminar</td>
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<tr>
<td>STAT:5100-</td>
<td>Statistical Inference I-II</td>
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<tr>
<td>STAT:5101</td>
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<tr>
<td>STAT:5200-</td>
<td>Applied Statistics I-II</td>
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<tr>
<td>STAT:5201</td>
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<tr>
<td>STAT:5400</td>
<td>Computing in Statistics</td>
</tr>
<tr>
<td>STAT:6220</td>
<td>Statistical Consulting</td>
</tr>
<tr>
<td>STAT:6300</td>
<td>Probability and Stochastic Processes I</td>
</tr>
<tr>
<td>STAT:6990</td>
<td>Readings in Statistics (two consecutive enrollments)</td>
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</tbody>
</table>

Actuarial Science/Financial Mathematics Concentration Area

Students in the actuarial science/financial mathematics concentration area must complete the following core courses from the M.S. in actuarial science program.

<table>
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<th>One of these sequences:</th>
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<tbody>
<tr>
<td>STAT:4100-</td>
<td>Mathematical Statistics I-II</td>
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<tr>
<td>STAT:4101</td>
<td></td>
</tr>
<tr>
<td>STAT:5100-</td>
<td>Statistical Inference I-II (for well-prepared students)</td>
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<tr>
<td>STAT:5101</td>
<td></td>
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<tr>
<td>All of these:</td>
<td></td>
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<tr>
<td>ACTS:3080</td>
<td>Mathematics of Finance I</td>
</tr>
<tr>
<td>ACTS:4130</td>
<td>Quantitative Methods for Actuaries</td>
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<tr>
<td>ACTS:4180 &amp;</td>
<td>Life Contingencies I-II</td>
</tr>
<tr>
<td>ACTS:4280</td>
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<tr>
<td>ACTS:4380</td>
<td>Mathematics of Finance II</td>
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<tr>
<td>ACTS:6160</td>
<td>Topics in Actuarial Science</td>
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<tr>
<td>ACTS:6480</td>
<td>Loss Distributions</td>
</tr>
<tr>
<td>ACTS:6580</td>
<td>Credibility and Survival Analysis</td>
</tr>
<tr>
<td>STAT:4510</td>
<td>Regression, Time Series, and Forecasting</td>
</tr>
</tbody>
</table>
A course approved by the advisor 3

All Concentration Area Courses
Additional Ph.D. core course work, regardless of concentration area, requires the following course work.

All of these:
- STAT:5120 Mathematical Methods for Statistics 3
- STAT:7100 Advanced Inference I-II 6
- STAT:7101 Linear Models 4
- STAT:7300 Foundations of Probability I 3
- STAT:7400 Computer Intensive Statistics 3

Seminars, chosen from STAT:7190 or STAT:7290 2 or STAT:7390 18

Concentration Areas
Students take at least four courses in one of the following concentration areas; at least one of the four courses must be at the Ph.D. level (numbered 7000 or above).

Statistical Computing
Statistical computing emphasizes the theory and application of a broad array of statistical models, such as linear, generalized linear, nonlinear, categorical, spatial, correlated response, and nonparametric regression models. This concentration area prepares students to specify and choose appropriate models; fit the models using available statistical software; and make sound statistical conclusions and interpretive statements. It is excellent preparation for students interested in academic, industrial, or government positions that involve data modeling and analysis.

- STAT:6510 Applied Generalized Regression 3
- STAT:6530 Environmental and Spatial Statistics 3
- STAT:6540 Applied Multivariate Analysis 3
- STAT:6560 Applied Time Series Analysis 3
- STAT:6970 Topics in Statistics 3
- STAT:7510 Analysis of Categorical Data 3
- STAT:7520 Bayesian Analysis 3
- STAT:7560 Time Series Analysis 3

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.

- STAT:6301 Probability and Stochastic Processes II 3
- STAT:7301 Foundations of Probability II 3
- STAT:7520 Bayesian Analysis 3
- STAT:7560 Time Series Analysis 3

Biostatistics
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.

- STAT:6530 Environmental and Spatial Statistics 3
- STAT:6540 Applied Multivariate Analysis 3
- STAT:7510 Analysis of Categorical Data 3
- STAT:7570 Survival Data Analysis 3
- BIOS:7310 Longitudinal Data Analysis 3

Actuarial Science/Financial Mathematics
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. Most students who choose this concentration area are admitted after earning an M.S. in actuarial science at the University of Iowa.

- STAT:6301 Probability and Stochastic Processes II 3
- STAT:7301 Foundations of Probability II 3
- STAT:7560 Time Series Analysis 3
- FIN:7110 Finance Theory I 3
- FIN:7130 Finance Theory II 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); and

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 five members, which is approved by the advisor. At least four 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 five committee members with a recognized scholar of professorial rank from another academic institution.

**Prospectus**

Within 12 months of passing the Ph.D. final exam, the candidate presents 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.

**Admission**

Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations of the Graduate College.

**Financial Support**

Funds are available to help support outstanding Ph.D. applicants. Fellowships, teaching assistantships, and research assistantships provide an attractive stipend plus tuition at the resident rate and tuition scholarships for students who are appointed at least one-quarter time. In most cases, full tuition waivers are granted.

Students who wish to be considered for financial assistance for their third year in the program should request to go through the Ph.D. qualifying process no later than the spring semester of their second year.

**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.

The program prepares students for careers in research, applications, and teaching. 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.