Statistics, PhD

Learning Outcomes

Graduates will be able to:

- have a solid understanding of the mathematical and statistical theory that underlies statistical methods;
- conduct literature reviews to summarize the state of the art for specific theoretical and applied topics;
- formulate, implement, and assess appropriate statistical models for analyzing data;
- identify limitations of existing methods and independently develop and assess novel methods (e.g., for analyzing new types of data);
- appreciate the issues of uncertainty, reproducibility, and computability in data analysis;
- collaborate with non-statisticians to help collect and analyze data; and
- acquire effective communication skills for disseminating statistical findings.

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, acquire the ability to use electronic digital computing equipment, or learn non-English language skills necessary for reading scientific journals and communicating with scholars in other languages.

PhD Qualifying Procedure

Statistics

After passing the MS final examination, a student who will choose biostatistics, probability/mathematical statistics, or data science as the selected concentration area can request to go through the PhD qualifying procedure. This request should be made by notifying the director of graduate studies. The qualifying procedure typically takes place in November or April each year. During the PhD qualifying procedure, the faculty evaluates the student's body of work, which includes the MS final examination in statistics, coursework, and evidence for research potential. Usually, a student needs to have demonstrated a high level of proficiency in their MS exam, earned a grade of A in at least one 7000-level course, completed at least 1 s.h. of STAT:6990 Readings in Statistics, and be enrolled in a second semester of STAT:6990. This evaluation and assessment results in one of three decisions: the student successfully passes the PhD qualifying procedure, the student must reapply to go through the PhD qualifying procedure after accumulating a larger body of work for evaluation, or the student fails to pass the PhD qualifying procedure and cannot continue in 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 section below on PhD comprehensive exam/ prospectus).

A student may be admitted directly to the PhD program. If direct admission is not granted, the student may petition to apply for PhD admission either after their MS examination or concurrently with the PhD qualifying procedure.

In exceptional cases, a student may petition to go through the PhD qualifying procedure early in their first year. However, passing the MS final exam is required before any student can go through the PhD qualifying procedure and take the PhD comprehensive 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 evaluates the student's body of work and assesses 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.

Required Courses

The following course lists outline required courses for each concentration area.

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.

Course #	Title	Hours
All of these from the MS in actuarial science program:		
ACTS:4130	Quantitative Methods for Actuaries	3
ACTS:4180	Life Contingencies I	3
ACTS:4280	Life Contingencies II	3

STAT:5100	Statistical Inference I	3
STAT:5101	Statistical Inference II	3
STAT:6300	Probability and Stochastic Processes I	3
All of these:		
STAT:5120	Mathematical Methods for Statistics	3
STAT:6200	Predictive Analytics	3
STAT:7100	Advanced Inference I	3
STAT:7200	Linear Models	4
STAT:7300	Advanced Probability	3
STAT:7400/ DATA:7400/ IGPI:7400	Computer Intensive Statistics	3
STAT:7990	Reading Research	22
DATA:7350	High-Dimensional Probability for Data Science	3
Seminars chosen from STAT:7190, STAT:7290, and STAT:7390		2
At least four of these, with at least one numbered 7000 or above:		
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
STAT:4560	Statistics for Risk Modeling I	3
STAT:4561	Statistics for Risk Modeling II	3
STAT:6301	Probability and Stochastic Processes II	3
STAT:7560	Time Series Analysis	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.

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/ IGPI:5199	Applied Statistics I	4
STAT:5201	Applied Statistics II	3
STAT:5400/ DATA:5400/ IGPI:5400	Computing in Statistics	3
STAT:6220/ DATA:6220	Consulting and Communication With Data	3
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/ DATA:7400/ IGPI:7400	Computer Intensive Statistics	3
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:6530/ IGPI:6530	Environmental and Spatial Statistics	3
STAT:7510/ BIOS:7410	Analysis of Categorical Data	3
STAT:7570/ BIOS:7210/ IGPI:7210	Survival Data Analysis	3
BIOS:6650/ EPID:6655/ IGPI:6650	Causal Inference	3
BIOS:6720	Statistical Machine Learning for Biomedical and Public Health Data	3
BIOS:7240	High-Dimensional Data Analysis	3
BIOS:7310/ IGPI:7310	Longitudinal Data Analysis	3
DATA:7350	High-Dimensional Probability for Data Science	3

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.

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/ IGPI:5199	Applied Statistics I	4
STAT:5201	Applied Statistics II	3
STAT:5400/ DATA:5400/ IGPI:5400	Computing in Statistics	3
STAT:6220/ DATA:6220	Consulting and Communication With Data	3
STAT:6300	Probability and Stochastic Processes I	3
STAT:6990	Readings in Statistics (two consecutive enrollments)	2
All of these:		

STAT:4540/ BAIS:4540/ DATA:4540/ IGPI:4540	Statistical Learning	3
STAT:4580/ DATA:4580/ IGPI:4580	Data Visualization and Data Technologies	3
STAT:5120	Mathematical Methods for Statistics	3
STAT:7100	Advanced Inference I	3
STAT:7200	Linear Models	4
STAT:7400/ DATA:7400/ IGPI:7400	Computer Intensive Statistics	3
STAT:7500/ BAIS:7500	Statistical Machine Learning	3
STAT:7990	Reading Research	18
DATA:7350	High-Dimensional Probability for Data Science	3
Seminars chosen from STAT:7190, STAT:7290, and STAT:7390		2
At least two of these, with at least one numbered 7000 or above:		
STAT:4750/ DATA:4750	Probabilistic Statistical Learning	3
STAT:6200/ ACTS:6200/ DATA:6200	Predictive Analytics	3
STAT:6530/ IGPI:6530	Environmental and Spatial Statistics	3
STAT:6560	Applied Time Series Analysis	3
STAT:6970	Topics in Statistics	3
STAT:7101	Advanced Inference II	3
STAT:7300	Advanced Probability	3
STAT:7510/ BIOS:7410	Analysis of Categorical Data	3
STAT:7520	Bayesian Analysis	3
STAT:7560	Time Series Analysis	3

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.

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/ IGPI:5199	Applied Statistics I	4
STAT:5201	Applied Statistics II	3
STAT:5400/ DATA:5400/ IGPI:5400	Computing in Statistics	3
STAT:6220/ DATA:6220	Consulting and Communication With Data	3
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/ DATA:7400/ IGPI:7400	Computer Intensive Statistics	3
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/ BAIS:7500	Statistical Machine Learning	3
STAT:7520	Bayesian Analysis	3
STAT:7560	Time Series Analysis	3
BIOS:6650/ EPID:6655/ IGPI:6650	Causal Inference	3
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 five 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 five 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 months of passing the PhD qualifying procedure, the candidate should present to the committee a written and oral prospectus, 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 modest 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 24–36 months of passing the PhD qualifying procedure. Failure to successfully defend the dissertation within 48 months of passing the PhD qualifying procedure or within five years of starting the graduate program at the University of Iowa, whichever comes first, will jeopardize the continuation of a student's financial support.

Admission

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

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 Your Career on the American Statistical Association website.

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

Academic Plans

Sample Plan 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, PhD

Data Science Concentration

This sample plan is currently being reviewed and will be added at a later date.