

Statistics - Ph. D.

Group 4: Cycle 1 - Fall 2017 - Fall 2018

Currently status is: Report Accepted

ASSESSMENT REPORT FOR Group 4: Cycle 1 - Fall 2017 - Fall 2018

Mission Statement

The Ph.D. program seeks to serve its students and society by offering a high-quality graduate experience that prepares future statistics faculty members and research statisticians for business, industry, and government. It strives to produce graduates who will substantially advance the state of knowledge in the field.

Goal 1.

The Doctor of Philosophy in Statistics is designed to prepare the student to teach statistics at the collegiate level, to do independent research, and/or work as a lead statistician in business or industry.

Curriculum

Beyond the coursework required for the master of science, tested in the Ph.D. qualifying exam, candidates for the Ph.D. are required to take additional advanced coursework in statistical theory, including: STAT 810 – Probability Theory I, STAT 811 – Probability Theory II, 721 – Stochastic Processes, STAT 822 – Advanced Statistical Inference, STAT 823 – Large Sample Theory, STAT 824 - Nonparametric Inference, and STAT 740 – Statistical Computing. They must successfully complete a doctoral dissertation that adds to the body of knowledge in the field, orally present that dissertation, and successfully pass an oral exam on the topics of the dissertation administered by at least four faculty members. Students who express the desire to pursue careers in academia are afforded the opportunity to teach, including weekly support meetings with the course coordinator.

Learning Outcome 1.

The Ph.D. recipient should have solid knowledge of the advanced theory of statistics and probability.

Measures and Criteria

Ph.D. students should successfully demonstrate mastery of the advanced theory of statistics and probability in the seven advanced courses expressly designed to cover the major topics in the area at the level appropriate for the Ph.D. Professors of Ph.D. required courses should rank at least 80% of students completing their courses as "adequate" in terms of mastery of the material. Students completing the Ph.D. theory courses should have confidence in their knowledge, and particularly in their ability to modify concepts and arguments presented in these courses to solve new methodological bottlenecks. Therefore, the median score on the exit survey question "How do you assess your ability to derive and interpret results in mathematical statistics?" should be at least "very good."

Methods

Success in meeting this learning outcome is evaluated every third year (the next round is academic year 2017-2018). Information for this evaluation include the students' demonstration of this knowledge through exams and coursework, a summary of each student's command over PhD core material as evidenced by their Comprehensive Examination, supplemented by the students' impressions of their knowledge as evaluated by the graduate student exit survey.

The professor(s) of STAT 810, 811, 721, 822, 823, 824, and 740 will evaluate student performance in the form of a written summary of the strengths and weaknesses of that cohort of students in terms of the course's subject matter. Specifically, each professor will delineate the most important areas in which students met or exceeded the expectations of the course's learning outcomes as listed in the course syllabus. As a summary measure, each professor will provide a proportion of students completing their course that are at least "adequate" in terms of mastery of the material.

Each student's Comprehensive Examination Committee will provide a brief written summary of the student's strengths and weaknesses in terms of PhD core sequence material in relation to the student's research topic(s) on the Statistics Department Comprehensive Examination (i.e. Dissertation Proposal) form.

The assessment coordinator will prepare a summary of student responses to the exit survey question: "How do you assess your ability to derive and interpret results in mathematical statistics?"

These results will be presented to the department's graduate committee who will prepare a report on the findings, along with initial suggestions for further refinement or improvement of the program if necessary. The committee report will be presented to the entire department as an agenda item at the annual department retreat.

Results

Q15 in Exit survey asks "How do you assess your ability to derive and interpret results in mathematical statistics?" The responses from 19 recent PhD recipients between 2015 and 2019 give 3 "Excellent", 13 "Very Good", and 3 "Good". This shows that over 81% of all PhD recipients responded "at least Very Good" in their ability to derive and interpret results in mathematical statistics.

The professors of STAT 810, 811, 721, 822, 823, 824, and 740 evaluated the student performance in their courses, and all of them reported that indeed more than 80% of their students are at least adequate in mastery of materials covered in their classes. See details below.

Professor Edsel Pena taught Stat 721 in Spring 2018 and provided the following report. This course is about stochastic processes, which are families of random variables that are indexed by "time" and which are associated or not independent of each other. A classic example of a stochastic process is the Dow Jones Industrial Average observed over time. The topics in this course are critical when one wants to understand dynamic aspects of a system. The topics covered are generating functions, discrete-time Markov Chains, branching processes (this is one of the main theories in the development of the atomic bomb!), Poisson processes, continuous-time Markov chains, birth-death processes, Gaussian processes, and a little bit of martingales. There were 14 enrolled students in this course. Problem sets were given regularly, and two take-home examinations were administered. Take-home format for the examinations is the most desirable in order to be able to give non-trivial problems that they could work on. Students were also required to do a project that uses stochastic processes and to present a written report about their project. At the end of the course, the course overall

scores ranged from 85.70 to 97.80 out of 100 points. One of the students got a grade of B+, while the others who had overall scores of at least 90 points got grades of A. Students took their projects seriously and since they have to write reports about their projects, they learned how to do some technical writing. Overall, I assess that the students got a good exposure into stochastic processes, which will enable them to pursue research problems which may require stochastic processes concepts and ideas, and be able to read the statistical, probability, and mathematical literature that utilize stochastic processes. **I rate that 100% of the class are at least adequate in material mastery.**

Professor Tim Hanson taught STAT 740 in Fall 2017 and provided the following assessment.

► understand algorithms for numerical integration and optimization apply them to obtain inference from statistical models;

Fall 2017 students roundly understood various important ideas behind numerical optimization and integration, including Newton-Raphson and related approaches, as well as adaptive quadrature for obtaining ML inference in GLMMs with Gaussian random effects, and the E-M algorithm. I would rate 100% of students as adequate here. In terms of Bayesian "integration", i.e. MCMC methods, a few students did not see the need to learn this (also evident in their course evaluations), so I'd say 80% were adequate.

► hand-program and validate various algorithms in R to obtain inference from a variety of models;

I was say about 90% were adequate here. There was a lot of writing R code from scratch and comparing to canned programs. Students fared quite well.