

To: Statistics Graduate Faculty
From: Glen Meeden, Gary Oehlert
Subject: Curriculum revision
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Introduction

We met On March 31,2006 to discuss the curriculum and agreed in principle on the following points:

- Move the Ph.D. written exam to after the first year (or before the second year) and reduce its coverage.
- Move 8801 “Consulting” to the fourth semester.
- Move 8054-B “Projects” from the fourth semester to later.
- Modify 8054-B “Projects” to include the possibility of an industrial internship in place of the on campus project.
- The asymptotics section of “Mathematical Statistics” should remain as a semester, rather than be expanded.

We discussed briefly the fate of the MS program, but without making any decisions.

The proposal below reflects those comments, plus some additional thoughts that Glen and I have had about scheduling and summers.

Proposed PhD Program

Requirements:

Theory Core	8101–2, 8111–2, 12 credits
Methods Core	8051–2–3–4, 14 credits (4-4-4-2)
Consulting	8802 (2 credit version of 8801)
Applied Project	8055, 2 credits
Literature Seminar	8913, four semesters of 1 credit each
Electives	Four approved courses of at least 3 credits each
Supporting Field	12 approved credits
Ph.D. prelim written exam	End of the first year
Ph.D. prelim oral exam	Early fall semester of the fourth year
Dissertation	
Ph.D. final oral defense	

1. The strong recommendation will be that the supporting field courses be Math 5615–6 (Real Analysis) and Math 8651–2 (Measure Theory and Probability). Students with a valid (and strong) argument for a different supporting field may apply to the DGS for approval.

2. Approved electives are 8-level Statistics and Biostatistics courses and other 8-level courses approved by the DGS. (One 5-level Statistics course may be used with DGS approval.)
3. The DGS can allow students to skip courses if they have already had the material in previous study.

Comments

Some motivating ideas behind this curriculum revision are (1) the core needs updating, (2) students need to get into research sooner, and (3) students need to finish in shorter times.

Updating is an obvious goal. We believe that this set of courses makes the core more modern, better organized, and less repetitive. There are some losses, however, notably discrete multivariate and more advanced linear model theory.

We approach getting students into research earlier from several fronts. First is the Literature Seminar. Our plan is that this seminar will have multiple objectives. It should

- Introduce students to current research literature.
- Encourage students to explain and critique the papers.
- Encourage students to think about alternative ways to attack the problems presented in the papers, as well as considering possible extensions.

In other words, we want students to interact and engage with the ideas in the papers, which is a good first step in becoming a researcher. Third year students are required to participate and present at the seminar; second year students are required to attend and may participate and present.

Second, the Applied Project course is essentially a foray into applied research while still under the wing of faculty guidance. One possibility is to “embed” the students with researchers around the University and have the students work on a project with that researcher. Alternatively, students can work on an industrial internship. Optimally, the students would do something interesting, get research and writing experience, and perhaps get their name on a publication.

Third, the Director and the DGS are reallocating funds to provide partial summer support to Ph.D. students after their first three years. (Present funding seems adequate to provide \$2,000 as a “Summer Fellowship,” although this means discontinuing the “School Fellowship.”) Summer funding also has multiple objectives. Most crudely, it is a way to get more money to students and thus serves as a recruiting tool. On a somewhat higher plane, this money will support the students to get into various kinds of research earlier.

- First year. Students who pass the Ph.D. written prelim at the end of May can be supported to do small research projects under the direction of faculty. At this stage of their careers, these projects should be at the level of a good Plan B, and might even be better.
- Second year. Students will register for 8055 (Applied Project) in the fall of their third year, but we can support them during their second summer while they do the applied research.
- Third year. Here we support students to work on their dissertation proposals and prepare for their oral exams. Students receiving this support would be expected to take their Ph.D. prelim oral early enough to be eligible to take thesis credits in the fall of their fourth year.

This support of students in the summer will require attention from faculty. In reverse order, dissertation advisors must work with their students over the summer to get them ready for their orals. Whoever is officially teaching the Applied Project course in the fall must be present in the summer to supervise. And we will need some faculty present in the summer to supervise the first year research projects. None of these requires everyone to be here everyweek, or even every summer, but it would be a shared responsibility.

Third, the DGS and the faculty need to set the expectation that students will proceed through the milestones at an acceptable pace.

Proposed Core Courses

Semester 1

8051: 4 credits

- **Computing and basic regression** Introduction to R, basic Monte Carlo, bootstrap and linear regression.
- **Generalized linear models** Much of what is now covered in 8061 but in the context of GLMs.

8101: 3 credits

- **Theory of Statistics I** Review of linear algebra, basic probability theory, distribution theory including the multivariate normal distribution.

Semester 2

8052: 4 credits

- **Experimental Design** Ideas of design plus methods of analysis for fixed effects designs.
- **Mixed Models:** Mixed models from the REML/ML point of view. Will include some time and spatial dependence.

8102: 3 credits

- **Theory of Statistics II** Standard frequentist inference (sufficiency, Neyman-Pearson lemma, MLE, etc) including theory for the normal linear model.

Semester 3

8053: 4 credits

- **Advanced Regression** Additive models, tree-based methods, smoothing, model selection, and dimension reduction.
- **Applied multivariate methods** Introduction to standard multivariate methods.

8111: 3 credits

- **Mathematical Statistics I** Ferguson-style decision theory, Bayesian methods, Stein estimation, and other topics at discretion of the instructor.

Semester 4

8054: 2 credits

- **Advanced Computing** Topics will include MCMC and optimization.

8802: 2 credits

- **Consulting** Two credit version of 8801, essentially leaving out the case studies thread.

8112: 3 credits

- **Mathematical Statistics II** Asymptotics, including a Markov chain central limit theorem.

Semesters 3, 4, 5, 6

8913: 1 credit

- **Literature Seminar**

Semester 5

8055: 2 credits

- **Applied Project** Students work on a substantial data analysis problem, including both oral and written presentations. Typically, students will be working with a University researcher from outside of Statistics, but the option of an industrial internship is available.

One question: should the theory classes remain 3 credits, or should some of them be changed to 4?

The MS program

Current MS students take 8061–2, but it will disappear in the new curriculum. 8061–2 is roughly equivalent to the triple 5302, 5303, and 5421 (regression, design, and categorical); the new 8051–2 is targeted for Ph.D. students, so it may be too fast paced for many MS students. We currently want MS students to take 8101–2, but many are not ready and take 5101–2 instead. The revised 8101–2 is only going to make that difference greater.

We have two options for the MS program:

- Have MS students take the first year Ph.D. curriculum (8101–2, 8051–2).
- Make 5101–2 the theory core and 5302, 5303, 5421 the methods core. Well prepared students would be allowed to substitute the Ph.D. core.

In either scenario, students would still need three electives, two supporting field courses, and consulting.

Choosing the first option will require us to shrink the MS program dramatically. Choosing the second option will allow our MS program to shrink only a little.

Under either option, we recommend that the MS exam be eliminated.