



Proposal to the Senate Educational Policy Committee

PROPOSAL TITLE: Revision of the Ph.D. in Statistics

SPONSOR: Xiaofeng Shao, Ph.D Advisor and Professor, Department of Statistics, Phone: 244-7285, email: xshao@illinois.edu

COLLEGE CONTACT: Karen Carney, Associate Dean, College of Liberal Arts and Sciences, kmcarney@illinois.edu

BRIEF DESCRIPTION: We propose to revise course requirements for Ph.D. degree in statistics to modernize the curriculum and increase the flexibility to pursue a wider range of advanced topics. In the revision, we maintain the previous requirements on the core courses for theory, method and computational statistics, but reduce the requirement on probability and measure theory and increase the electives for theory and applications. The new course requirements are more flexible and provide greater opportunity for specializing in a range of different areas of statistics. This update also includes newly developed courses and cross-listing of existing courses in Statistics to increase the range of study.

JUSTIFICATION: Statistics as a discipline has been changing over time. Motivated by applications from various emerging areas, new statistical theory and methods have been recently developed. To adapt to the change and provide proper training to a new generation of statisticians, the course requirements for our Ph.D. students also need to be revised.

BUDGETARY AND STAFF IMPLICATIONS:

1) Resources

- a. How does the unit intend to financially support this proposal?
 - This proposal is not expected to require any additional financial support.
- b. How will the unit create capacity or surplus to appropriately resource this program? If applicable, what functions or programs will the unit no longer support to create capacity?

- This proposal is not expected to impact the distribution of resources within the department.
- c. Will the unit need to seek campus or other external resources? If so, please provide a summary of the sources and an indication of the approved support.
- The department is not seeking campus or external resources for this proposal.
- d. Please provide a letter of acknowledgment from the college that outlines the financial arrangements for the proposed program.
- N/A

2) Resource Implications

- a. Please address the impact on faculty resources including the changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc.
- This proposal is not expected significantly impact resources. While there will be greater flexibility for which courses to choose, the same amount of total credit hours are required to obtain the degree.
- b. Please address the impact on course enrollment in other units and provide an explanation of discussions with representatives of those units. *(A letter of acknowledgement from units impacted should be included.)*
- The impact on course enrollment within other units is expected to be minimal. Discussion has taken place with all other affected units and all have been in agreement that the benefit of having Statistics students within the courses would be of benefit or have minimal impact on the current instructors.
- c. Please address the impact on the University Library
- This proposal is not expected to impact the library.
- d. Please address the impact on technology and space (e.g. computer use, laboratory use, equipment, etc.)
- This proposal is not expected to impact technology or space needs.

DESIRED EFFECTIVE DATE: Fall 2017

STATEMENT FOR ACADEMIC CATALOG:

Overview Tab- no revisions

<http://www.stat.illinois.edu>

Chair of the Department: Douglas G. Simpson

Director of Ph.D. Program: Xiaofeng Shao

Director of M.S. Program: David Dalpiaz

Contact: Aaron Thompson

101 Illini Hall

725 South Wright Street

Champaign, IL 61820

(217) 333-2167

stat-office@illinois.edu

Major: Statistics

Degrees Offered: M.S., Ph.D.

Graduate Concentrations: Analytics (M.S. only), Applied Statistics (M.S. only)

Medical Scholars Program: Doctor of Philosophy (Ph.D.) in Statistics and Doctor of Medicine (M.D.) through the [Medical Scholars Program](#)

Graduate Degree Programs

The Department of Statistics offers graduate study leading to the Master of Science in Statistics, the Master of Science in Statistics with specialization in various areas of application, and the Doctor of Philosophy in Statistics.

Admission

Graduate College admission requirements apply. Students are expected to have a strong undergraduate mathematics background, but need not have an undergraduate statistics or mathematics degree. Students may be admitted with deficiencies, which are to be removed during the first year of graduate work. A minimum Test of English as a Foreign Language (TOEFL) score of 590 for the paper-based test or 243 for the computer-based test is required for students whose native language is not English. The Graduate Record Examination (GRE) is required. The department offers Ph.D. admissions for the fall only.

Medical Scholars Program

The Medical Scholars Program permits highly qualified students to integrate the study of medicine with study for a graduate degree in a second discipline, including Statistics. Students may apply to the Medical Scholars Program prior to beginning graduate school or while in the graduate program. Applicants to the Medical Scholars Program must meet the admissions standards for and be accepted into both the doctoral graduate program and the College of Medicine. Students in the dual degree program must meet the specific requirements for both the medical and graduate degrees. On average, students take eight years to complete both degrees. Further information on this program is available by contacting the Medical Scholars Program, 125 Medical Sciences Building, (217) 333-8146 or at www.med.illinois.edu/msp.

Graduate Teaching Experience

Although teaching is not a general Graduate College requirement, experience in teaching is considered an important part of the graduate experience in this program.

Financial Aid

Financial aid is available primarily in the form of teaching assistantships, research assistantships, and fellowships. For further information write to the Graduate Admissions Committee, Department of Statistics.

Doctoral Tab

Doctor of Philosophy in Statistics

MS Equivalent Core

STAT 424	Analysis of Variance	4
STAT 425	Applied Regression and Design	4
STAT 426	Sampling and Categorical Data	4
STAT 510	Mathematical Statistics I	4

Theory Core Courses

STAT 511	Mathematical Statistics II	4
STAT 553	Probability and Measure I	4
STAT 575	Large Sample Theory	4

Select one Practicum course		4
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STAT 427	Statistical Consulting	
STAT 593	STAT Internship	
STAT 595	Preparing Future Faculty	

Select one Computational Theory and Methods Course		4
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STAT 428	Statistical Computing	
STAT 525	Computational Statistics	
STAT 530/CHBE 571	Bioinformatics	
STAT 542	Statistical Learning	

Select one of the Stochastic Processes and Time Series Courses		4
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STAT 429	Time Series Analysis	
STAT 555/MATH 564	Applied Stochastic Processes	
STAT 433	Stochastic Processes	
STAT 554	Probability and Measure II	

Select at least 3 elective courses chosen from a list within the department. At least two courses must be at the 500-level.		12
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Thesis and Individual Study Courses		0-32
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STAT 591	Individual Study and Research	
STAT 599	Thesis Research	

Total Hours		64
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Other Requirements'

Other requirements may overlap

Masters Degree Required for Admission to PhD?

No, but Masters level requirements must be met (32 additional hours min)

Minimum GPA: 2.75

For additional details and requirements refer to the department's Graduate Programs and the Graduate College Handbook.

Signatures:

Douglas E. Sims

Unit Representative:

1/13/2017

Date:

Karen M. Carney

2-23-17

College Representative:

Date:

[Signature]

Graduate College Representative:

3/17/17

Date:

Appendix A

Detailed PhD Requirements

Hours Course Requirements

Prerequisite:

- 4 MATH 447 - Real Variables (*Waived if a course at an equivalent level has been taken at another institution and a grade of B or above is achieved)

Required courses:

16 **MS equivalence core courses:**

(Waived with approved MS degree AND if passed the PhD qualifying exam)

STAT 424 - Advanced Linear Models

STAT 425 - Applied regression and design

STAT 426 - Sampling and Categorical Data

STAT 510 - Mathematical Statistics I

12 **Ph.D. theory core courses:**

STAT 511 - Mathematical Statistics II (waived with approved MS degree AND if passed PhD qualifying exam)

STAT 553 - Probability and Measure I

STAT 575 - Large Sample Theory

4 **Practicum course: select one**

STAT 427 - Statistical Consulting

STAT 593 - Internship

STAT 595 - Preparing Future Faculty

4 **Select at least one computational theory and methods course:**

STAT 428 - Statistical Computing

STAT 525 - Computational Statistics

STAT 530/CHBE 571 - Bioinformatics

STAT 542 - Statistical Learning

4 **Select at least one of the stochastic processes and time series courses:**

STAT 429 - Time Series Analysis

STAT 555/MATH 564 - Applied Stochastic Processes

STAT 433 - Stochastic Processes (pending approval)

STAT 554 – Probability and Measure II

0-32 **Thesis and individual study courses:**

STAT 590 - Individual Study and Research

STAT 599 - Thesis Research

- 12 **Elective courses**
Select at least 3 elective courses with at least two 500 level courses, not selected above

STAT 427 - Statistical Consulting
STAT 428 - Statistical Computing
STAT 429 - Time Series Analysis
STAT 430 - Topics in Applied Statistics
STAT 431 - Bayesian Statistics (pending approval)
STAT 432 - Fundamental of Statistical Learning (pending approval)
STAT 433 - Stochastic processes (pending approval)
STAT 434 - Survival Analysis 1 (pending approval)
STAT 435 - Clinical Trials Methodology (pending approval)
STAT 440 - Data Management
STAT 443 - Professional Statistics
STAT 448 - Advanced Data Analysis
STAT 458 - Math Modeling in Life Sciences
STAT 466 - Image and Neuroimage Analysis
STAT 480 - Data Science Foundations

STAT 525 - Computational Statistics
STAT 530 - Bioinformatics
STAT 534 - Survival Analysis 2 (pending approval)
STAT 542 - Statistical Learning
STAT 545 – Spatial Statistics (pending approval)
STAT 551/Math561 - Theory of Probability I
STAT 552/Math562 – Theory of Probability II
STAT 554 - Probability and Measure II
STAT 555 - Applied Stochastic Processes
STAT 571 - Multivariate Analysis
STAT 578 - Topics in Statistics (if the topic is different, it can be taken multiple times and counted as a different course)
STAT 587 - Hierarchical Linear Models
STAT 588 - Covariance Structures and Factor Models
STAT 593 - Internship
STAT 595 - Preparing Future Faculty

Approved elective courses offered by other departments (other courses subject to approval by the Ph.D. committee)

CS 512 - Data Mining Principles
CS 543 - Computer Vision
CS 546 - Machine Learning in NLP
CS 573 --- Algorithms
CS 583 --- Approximation Algorithms

ECE 547 - Topics in Image Processing
ECE 561 - Detection and Estimation Theory
ECE 563 - Information Theory

ECE 580 - Optimization by Vector Space Methods

ECON 536 – Applied Econometrics

ECON 574 – Econometrics I

ECON 575 - Econometrics II

ECON 576 - Time Series

ECON 590 - Applied Macroeconometrics

ECON 590 - Applied Financial Econometrics

IE 510 – Applied Nonlinear Programming

IE 521 – Convex Optimization

IE 528 – Computing for Data Analytics

IE 529 – Stats of Big Data & Clustering

MATH 540 - Real Analysis

MATH 580 - Combinatorial Mathematics

MATH 585 - Probabilistic Combinatorics

MATH 588 - Optimization in Networks

MATH 589 - Conjugate Duality and Optimization

Appendix B: Current/Proposed Curriculum Revisions

Current Requirements:		Current Hours	Proposed Requirements:	Proposed Hours
<u>STAT 424</u>	Analysis of Variance	4	STAT 424- Analysis of Variance	4
<u>STAT 425</u>	Applied Regression and Design	4	STAT 425- Applied Regression and Design	4
<u>STAT 426</u>	Sampling and Categorical Data	4	STAT 426- Sampling and Categorical Data	4
<u>STAT 510</u>	Mathematical Statistics I	4	STAT 510- Mathematical Statistics I	4
<u>STAT 511</u>	Mathematical Statistics II	4	Theory Core Courses STAT 511- Mathematical Statistics II	4
Select one of the following pairs: STAT 553 & STAT 554 or STAT 551 & STAT 552		8	STAT 553- Probability and Measure I	4
<u>STAT 575/ECON 578</u>	Large Sample Theory	4	STAT 575- Large Sample Theory	4
<u>STAT 427</u>	Statistical Consulting	4	Select one Practicum course STAT 427- Statistical Consulting STAT 593- STAT Internship STAT 595- Preparing Future Faculty	4
<u>STAT 428</u>	Statistical Computing	4	Select one Computational Theory and Methods Course STAT 428- Statistical Computing STAT 525- Computational Statistics STAT 530/CHBE 571- Bioinformatics STAT 542- Statistical Learning	4
<u>STAT 429</u>	Time Series Analysis	4	Select one of the Stochastic Processes and Time Series Courses STAT 429- Time Series Analysis STAT 555/MATH 564 - Applied Stochastic Processes STAT 433- Stochastic Processes STAT 554- Probability and Measure II	4

<u>STAT 525</u>	Computational Statistics	4	Select at least 3 elective courses chosen from a list within the department. At least two courses must be at the 500-level.	12
<u>STAT 571</u>	Multivariate Analysis	4		
<u>STAT 578</u>	Topics in Statistics	4	Thesis and Individual Study Courses STAT 591- Individual Study and Research STAT 599- Thesis Research	0-32
<u>STAT 599</u>	Thesis Research (0 min applied)	0		
Total Required Hours		64	Total Required Hours	64

#supporting email from Professor Perry, Head of Economics Dept

Dear Professor Shao

Our Department supports the proposed revision of the Statistics Ph.D. Program that includes the following economics courses as electives for the Ph.D. students in Statistics.

ECON 536 – Applied

Econometrics ECON 574 –

Econometrics I ECON 575 -

Econometrics II ECON 576 -

Time Series

ECON 590 - Applied Macroeconometrics

ECON 590 - Applied Financial Econometrics

The Statistics Ph.D. students enrolling in these courses will not create a problem for our faculty teaching these courses. Indeed, the Economics Ph.D. students will benefit from having Statistics Ph.D. students taking these courses.

The two new courses with a 590 number will be created as regular courses with a permanent number. We will notify you when that process is complete.

We will also notify you of any new courses that we create which might be interesting for your students.

Martin K. Perry

Head, Department of Economics

University of Illinois at Urbana-

Champaign

#supporting email from Robert Rutenbar, Head of Computer Science Department

Dear Xiaofeng

Thank you for sharing your proposed plans to change the PhD program requirements for Statistics, and to allow Statistics students to select electives from a set of advanced Computer Science courses in the areas of algorithms, AI, and data mining. I support your proposed changes; these courses are certainly making strong use of modern statistical techniques, and represent excellent examples of computing applications of these foundational statistics methods. As such, it very appropriate to allow them to be used as electives for your PhD program.

Sincerely

Rob A Rutenbar

Rob A. Rutenbar

Bliss Professor and Head, Dept of Computer

Science University of Illinois at Urbana-

Champaign

2232 Siebel Center, 201 North Goodwin Ave, Urbana IL

61801 Tel 217-333-3373 rutenbar@illinois.edu

Assistant: Amy Simons (aoboyle@illinois.edu 217-333-6079)

#supporting email from Matthew Ando, Chair of Math Department

Dear Xiaofeng,

I have consulted Mathematics's Graduate Affairs Committee and Director of Graduate Studies. The Department of Mathematics supports the proposed revision of the Statistics PhD program that includes

MATH 540 - Real Analysis

MATH 580 - Combinatorial

Mathematics MATH 585 - Probabilistic

Combinatorics MATH 588 -

Optimization in Networks

MATH 589 - Conjugate Duality and Optimization

as elective options. The effect on enrollments is expected to be acceptably small compared to the overall enrollment in these courses.

Regards,

Matthew Ando

Professor and Chair

Department of Mathematics

University of Illinois at Urbana-Champaign

#supporting email from Nitin Vaidya, Associate Head at Electrical and Computer Engineering Department

Dear Professor Shao,

The ECE Department supports the proposed revision of the Statistics Ph.D. program that includes the following four ECE courses as elective options.

ECE 547 - Topics in Image Processing

ECE 561 - Detection and Estimation Theory

ECE 563 - Information Theory

ECE 580 - Optimization by Vector Space Methods

We anticipate that the effect on enrollments in these courses will be small compared to the overall enrollment. The proposed revision will benefit the students in Statistics as well as in our own program through the interdisciplinary interactions that these elective course options will foster.

Sincerely,

Nitin Vaidya

Professor, and Associate Head

Department of Electrical and Computer Engineering

#supporting letter from Rakesh Nagi, Head of Department of Industrial and Enterprise Systems Engineering

September 15, 2016

Professor Xiaofeng Shao

Ph.D. Program Director

Department of Statistics

University of Illinois at Urbana-Champaign

Re: ISE Department support for Statistics PhD program

Dear Professor Shao,

Our department supports the proposed revision of the Statistics PhD program that includes

IE 510 – Applied Nonlinear Programming

IE 521 – Convex Optimization

IE 528 – Computing for Data Analytics

IE 529 – Stats of Big Data & Clustering

as elective options. The effect on enrollments is expected to be minimal compared to the overall enrollment in these courses. This will benefit the students in Statistics as well as in our own program through the interdisciplinary interactions that these elective course options will foster.

Please let me know if I can be of further assistance.

Sincerely,

Rakesh Nagi

Willett Professor and Head

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

EP.17.84

Office of the Provost and Vice Chancellor for Academic
Affairs

Swanlund Administration Building
601 East John Street
Champaign, IL 61820



March 17, 2017

Bettina Francis, Chair
Senate Committee on Educational Policy
Office of the Senate
228 English Building, MC-461

Dear Professor Francis:

Enclosed is a copy of a proposal from the College of Liberal Arts and Sciences to revise the course requirements for the Ph.D. in Statistics.

Sincerely,

A handwritten signature in cursive script, appearing to read 'Kathryn A. Martensen'.

Kathryn A. Martensen
Assistant Provost

Enclosures

c: A. McKinney
X. Shao
K. Carney
J. Hart