I L L I N O I S
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Proposal to the Senate Educational Policy Committee

PROPOSAL TITLE:

Establish a New Concentration "Actuarial Science and Risk Analytics" within the PhD in Mathematics (Department of Mathematics, College of Liberal Arts and Sciences) and revise the PhD in Mathematics.

SPONSOR:

Richard Laugesen, Professor of Mathematics and Director of Graduate Studies, 333-1329, laugesen@illinois.edu

Runhuan Feng, Associate Professor of Actuarial Science and Interim Director of Actuarial Science, 333-5630, rfeng@illinois.edu

COLLEGE CONTACT: Associate Dean Karen Carney, College of Liberal Arts and Sciences, kmcarney@illinois.edu, 333-1350

BRIEF DESCRIPTION:

Academic. This proposal seeks to establish a Concentration in the PhD program in Mathematics. The Concentration is designed to attract students with strong quantitative skills and interest in financial risk analytics and actuarial applications of mathematics, and to equip them with advanced analytical tools for professional and academic careers.

The Concentration extends the current PhD program. Students in the Concentration will be required to choose particular courses for the "core" requirements in the PhD program, and to take an additional 19 hours of coursework in actuarial science, finance, and statistics.

Students in the Actuarial Science and Risk Analytics concentration will be required to choose four of their core courses as: MATH 540 (Real Analysis), MATH 561 (Theory of Probability I), MATH 563 (Risk Modeling and Analysis), STAT 510 (Mathematical Statistics I). The Department maintains a list of appropriate core courses from which students select one additional course. Justification: this coursework is foundational for research in actuarial science and risk analytics. A letter of support from the Department of Statistics is included in this proposal.

Students are asked to demonstrate competence in these core courses.

How "competence" is assessed. The required standard of competence in undergraduate complex analysis and in core graduate courses is determined by our departmental Graduate Affairs Committee and published in the Guide for Graduate Students in Mathematics. The standard for competence in undergraduate complex analysis is a grade of B or better in an undergraduate or graduate complex

analysis course at the University of Illinois. Competence in the five core graduate courses is defined as earning a grade of A- or better in three of the courses, and B+ or better in the other two. Alternatively, a student may demonstrate competence by passing a proficiency exam on the course material, where offered. These standards of competence will continue to apply to all PhD students, including students in the proposed Concentration.

Students in the Concentration must also demonstrate competence in five additional supporting courses, as follows.

(i) In MATH 564, STAT 425, FIN 591, students must get a grade of B or better. Alternatively, the Director of Actuarial Science may determine competence on the basis of other achievements; for example, the student might have passed a comparably difficult course at another institution.
(ii) Students must earn a grade of B+ or better in two of the following courses, or else pass the corresponding professional actuarial exam: MATH 565, MATH 567, MATH 568.

Note: MATH 500 will not be required for students in the Concentration, although it is required for other PhD students. Students in the Concentration are required to demonstrate competence in linear algebra as a prerequisite for admission to the Concentration. The Director of Actuarial Science will determine their competence by means of a graduate level proficiency examination, or by a sufficiently high grade in prior coursework, or by MATH 500 itself.

Administrative. The Concentration will be administered by the Director of Graduate Studies (DGS) and Director of Actuarial Science (DAS) in the Department of Mathematics. The DAS will advise students through the Concentration and will certify completion of the Concentration requirements. Policy oversight is to be provided by the departmental Graduate Affairs Committee (GAC).

Admission to the Concentration will generally take place at the time of entry into the Mathematics PhD program, although qualified students can also be considered for admission at a later stage during their doctoral studies. Note that PhD students in Mathematics are not required to pursue a Concentration, and the proposed Concentration does not fulfill a requirement of the PhD program.

JUSTIFICATION:

The University of Illinois has had for decades a leading undergraduate actuarial science program. That program has been named a Center of Actuarial Excellence, one of just a few in the U.S. to be named as such by the Society of Actuaries—the world's leading actuarial professional organization. Building upon this record of excellence in undergraduate education, the Department of Mathematics intends to develop commensurately strong graduate offerings in actuarial science.

Competitor programs in actuarial science have extensive track records of producing and placing PhD's in top positions in academia and industry. Those graduate programs are known quantities to the actuarial science community and their degree names often contain "actuarial science".

The Concentration in Actuarial Science and Risk Analytics at the University of Illinois will provide a formal credential that is immediately recognizable to industry and academia. It will mark the special nature of the program within Mathematics at Illinois and within the campus. It will demonstrate our graduates' breadth and depth of expertise to the international actuarial research community and to corporate and government employers.

The Concentration will help us compete for the best students and faculty against longer-established graduate programs such as the top-ranked Actuarial Science PhD program at the University of Waterloo, by signaling to students and faculty internationally that Illinois will provide a top-quality doctoral experience.

We regard this concentration as a first step toward the eventual creation of a new PhD program in Actuarial Science and Risk Analytics, a PhD program that can compete with the best in the world.

BUDGETARY AND STAFF IMPLICATIONS:

1) Resources
   a. How does the unit intend to financially support this proposal?

      PhD students in this concentration are to be funded by teaching assistantships, research assistantships, and fellowships, just as for other students in the PhD program.

   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?

      All PhD students receive financial support through fellowships, teaching and/or research assistantships. Approximately 130 PhD students in the department are supported by teaching assistantships in a typical Fall semester (and about 110 students in Spring semesters). This number will not grow with the new Concentration. Neither will overall PhD student numbers grow. Rather, we expect a gradual redistribution among sub-areas of the department as the new concentration attracts PhD applicants with financial interests. This kind of redistribution happens naturally all the time, as faculty strength in different areas of Mathematics shrinks and grows. For example, this year two of the incoming PhD students are intending to specialize in actuarial science. Faculty strength is expected to grow too, because the college has approved a search in the area for the coming year.

   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.

      No. Faculty members who advise students in the Concentration will seek research assistant funding from federal granting agencies and private foundations, just as faculty members do in the rest of the PhD program. For example, State Farm Companies Foundation has consistently provided the Mathematics Department with fellowships designed for PhD students with research interests in actuarial and financial applications. These fellowships supplement our teaching assistantships, but are not necessary for the viability of the Concentration.

   d. Please provide a letter of acknowledgment from the college that outlines the financial arrangements for the proposed program.

      Attached.

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.

      Due to the small number of students to be admitted (2-3 per year), the proposed concentration will not drive any change in the number of faculty or graduate class size, or any noticeable change in student-faculty ratio for the Department as a whole. Faculty members with actuarial and financial research interests will advise more PhD students than previously, of course, rising over the next six years to perhaps four advisees each.

Students will have access to existing job placement resources: the Graduate College Career Development office; Actuarial Science Club (which holds "Meet the Firms" nights and an Actuarial Recruitment Conference); Mathematics Department career events and the careers listserv; Mathematics alumni network. Faculty commitment to these job placement activities will be unaffected by the Concentration.

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.)*

We have discussed the proposal with the Departments of Finance and Statistics, since some of their courses are required for the new concentration. Due to the small number of students (2-3 per year), we do not expect the introduction of the new concentration to have any material impact on their course enrollments. Further, note the proposed concentration does not resemble any degree program currently offered by the two departments.

c. Please address the impact on the University Library *(A letter of estimated impact from the University Librarian must be included for all new program proposals. If the impact is above and beyond normal library business practices, describe provisions for how this will be resourced.)*

We foresee no noticeable impact on the University Library. See the letter of estimated impact from the University Librarian.

d. Please address the impact on technology and space (e.g. computer use, laboratory use, equipment, etc.)

No impact is anticipated on computer or laboratory use. The Department already provides computer labs and office space for all Mathematics PhD students.

DESIRED EFFECTIVE DATE: Fall 2017

Doctor of Philosophy in Mathematics

Students working toward a Ph.D. degree usually require from four to six years to complete the requirements. Each student must pass the comprehensive examinations (testing the student's knowledge of basic graduate-level mathematics in algebra, analysis, and other areas) and the preliminary examination (testing the student's ability to begin or continue research in a chosen field). Students must also write and defend a research thesis in their field of mathematics.

Course List

Code	Title	Hours
Students must demonstrate competence in five core courses. Two of these are required to be MATH 500 (Abstract Algebra)* and MATH 540 (Real Analysis). Students must also demonstrate proficiency in undergraduate complex analysis.		
Master's equivalency		32
MATH 599	Thesis Research (0 min applied toward degree)	0
Total Hours required for the degree		96

Students in the Actuarial Science and Risk Analytics concentration are not required to take MATH 500.

Other Requirements[1]

Grad Other Degree Requirements

Requirement	Description
Other requirements may overlap	
MATH 405, MATH 406, MATH 415, MATH 444, and MATH 499 cannot be counted toward this graduate degree.	
64 hours in residence	
Masters Degree Required for Admission to PhD?	No
Comprehensive Exam Required	Yes
Preliminary Exam Required	Yes
Final Exam/Dissertation Defense Required	Yes
Dissertation Deposit Required	Yes
Minimum GPA:	3.25

[1] *For additional details and requirements refer to the department's Guide to Graduate Studies and the Graduate College Handbook.*

Doctor of Philosophy in Mathematics - Actuarial Science and Risk Analytics Concentration

Students working toward a Ph.D. degree usually require from four to six years to complete the requirements. Each student must pass the comprehensive examinations (testing the student's knowledge of basic graduate-level mathematics in algebra, analysis, and other areas) and the

preliminary examination (testing the student's ability to begin or continue research in a chosen field). Students must also write and defend a research thesis in their field of mathematics.

Course List		
Code	**Title**	**Hours**
Students must demonstrate competence in five core courses including the following: MATH 540 - Real Analysis MATH 561 - Theory of Probability I MATH 563 - Risk Modeling and Analysis STAT 510 - Mathematical Statistics I		
Students must also demonstrate proficiency in undergraduate complex analysis.		
Students must demonstrate competence in the following: MATH 564 - Applied Stochastic Processes STAT 425 - Applied Regression and Design FIN 591- Theory of Finance		
Students must demonstrate competence in two of the following: MATH 565 - Actuarial Models for Life Contingencies MATH 567 - Actuarial Models for Financial Economics MATH 568 - Actuarial Loss Models		
Master's equivalency		32
MATH 599	Thesis Research (0 min applied toward degree)	0
Total Hours required for the degree		96

Other Requirements[1]

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[1] *For additional details and requirements refer to the department's Guide to Graduate Studies and the Graduate College Handbook.*

Mathematics Academic Catalog Overview Tab (new info highlighted)

http://www.math.illinois.edu

Chair of the Department: Matthew Ando
Director of Graduate Studies: Richard Laugesen
273 Altgeld Hall
1409 West Green Street
Urbana, IL 61801
(217) 333-5749
E-mail: math-grad@illinois.edu

Major: Applied Mathematics
Degrees Offered: M.S.
Graduate Concentration: Actuarial Science (in Applied Mathematics only)

Major: Mathematics
Degrees Offered: M.S., Ph.D.
Graduate Concentration: Actuarial Science and Risk Analytics (PhD only)

Major: Teaching of Mathematics
Degrees Offered: M.S.

Medical Scholars Program: Doctor of Philosophy (Ph.D.) in Mathematics and Doctor of Medicine (M.D.) through the Medical Scholars Program

Graduate Degree Programs

The department offers graduate study leading to the Master of Science in Mathematics, the Doctor of Philosophy in Mathematics, the Master of Science in Applied Mathematics, and the Master of Science in the Teaching of Mathematics. Opportunity also exists for specializing in computational science and engineering within the department's graduate programs via the Computational Science and Engineering (CSE) Option.

Admission

In addition to the University requirements for admission to the Graduate College, there are a number of requirements that are specific to the Department of Mathematics.

GRE (Graduate Record Examination) scores are required by the Department of Mathematics, both the general test and the subject test in mathematics, for admission from all applicants to the PhD program who live in the United States or Canada. The tests are not required from other applicants, but students' chances of admission and of receiving financial aid will be better if they submit these test scores. GRE scores are also required for all fellowship applications.

All students admitted to the PhD program must have full financial support, either from the Department of Mathematics (teaching assistantship or fellowship) or from another source (minimum 5 years).

For students whose native language is not English the University admission requirements include proof of proficiency in English, as measured by the TOEFL (Test of English as a Foreign Language) or IELTS (International English Language Testing System). For more information on these requirements for admission see www.grad.illinois.edu/admissions/taengprof.htm.

In addition, a minimum TOEFL iBT speak score of 22 (or IELTS 6.5) is required to be considered for the Math Ph.D. program at Illinois. A minimum TOEFL iBT score of 20 (IELTS 6.0) is required to be considered for the Math M.S. programs at Illinois. The only exceptions will be for those applicants exempt from the English requirement for admission, (see www.grad.uiuc.edu/admissions/instructions/04c).

In addition, International Teaching Assistants must demonstrate proficiency in spoken English, as measured by the Internet Based TOEFL (iBT), the IELTS, the TSE (Test of Spoken English), or the university-administered EPI (English Proficiency Interview) test. For more information on these requirements for appointment as an International TA see cte.illinois.edu/testing/oral_eng/main.html. Students who do not satisfy these requirements are not eligible to receive appointments as Teaching Assistants in the classroom.

International students who have studied in the United States may be exempt from the English admission requirement, but must still submit the TOEFL or equivalent to qualify as a teaching assistant.

The submission deadline for applications for Fall Semester that include a request for financial aid is January 5. The deadline for supplemental materials (including letters of recommendation and transcripts) is January 5. Only applications which are complete will be reviewed. Applications for admission to M.S. programs without funding can be considered up to March 1. The deadline for all applications for spring semester is the preceding October 1. The Department of Mathematics reserves the right to close the acceptance of applications at any time.

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 mathematics. 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 in the form of teaching assistantships, research assistantships, and fellowships. The same application is used for decisions on admission, assistantships, and fellowships. The deadline for equal consideration for fellowships and assistantships is January 5, but later applications for assistantships will be considered if positions are available.
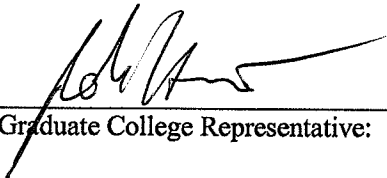
CLEARANCES:

Signatures:

(signature)
Unit Representative:

Date: 10/4/16

Karen M Carney
College Representative:

Date: 11-21-16

(signature)
Graduate College Representative:

Date: 2/20/17

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From: Chan, Kuo Chi
Sent: Thursday, May 12, 2016 11:07 AM
To: Feng, Runhuan
Cc: Almeida, Heitor; Pennacchi, George G
Subject: RE: A proposal for a new concentration of math PhD in actuarial science

The instructor for FIN 591 has agreed to allow in
Math PhD students in Actuarial Science. The
understanding is that there will be no more
than 2-3 students a year.

Thanks,
Louis

From: Feng, Runhuan
Sent: Wednesday, May 11, 2016 5:14 PM
To: Almeida, Heitor; Chan, Kuo Chi
Cc: Widdicks, Martin; Vonnahme, Mark C
Subject: RE: A proposal for a new concentration of math PhD in actuarial science

Hi, Louis.

It was a great pleasure meeting you and Mark today. I am glad that we started on
another frontier for collaboration.

Thanks for the inputs on the required finance course. I agree with you that FIN
591 would be at the appropriate level for our PhD students. We actually do teach
option pricing theory at the master's level in the actuarial program. Your course
would have more in-depth coverage. I will propose to the GAC to include FIN 591
as a required course for the ActSci concentration then. Other recommended
finance courses will appear in the department's program guide but do not go on
to the official proposal at this point.

Regards,
Runhuan

Department of Finance

College of Business
340 Wohlers Hall, MC-706
1206 South Sixth Street
Champaign, IL 61820-6980

Louis K. C. Chan
Hoeft Professor and Department Chair

MEMORANDUM

To: Richard Laugesen, Professor of Mathematics and Director of Graduate Studies, Department of Mathematics; Runhuan Feng, Assistant Professor of Actuarial Science, Department of Mathematics

From: Louis K. C. Chan, Hoeft Professor of Finance and Chair, Department of Finance *Ukee*

Date: 12 August 2016

Re: Support for proposed new Concentration "Actuarial Science and Risk Management" in the PhD in Mathematics (Department of Mathematics, College of Liberal Arts and Sciences)

On behalf of the Executive Committee of the Department of Finance, I write to express our strong support for establishing a concentration in Actuarial Science and Risk Management in the PhD in Mathematics program. The field of finance has a long tradition of borrowing tools from mathematics to develop new models to enhance our understanding of the behavior of financial markets. As a result, we are happy to support efforts by the University of Illinois Department Of Mathematics to provide advanced training to students to pursue research that will be beneficial to both mathematics and finance. Given the projected size of the program (2-3 students per year) in the foreseeable future, we do not anticipate any material impact on enrollment in existing courses, or other resources.

June 29, 2016

Matthew Ando
Professor and Chair, Department of Mathematics
University of Illinois at Urbana-Champaign
273 Altgeld Hall
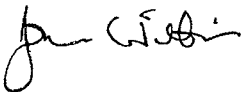1409 W. Green Street (MC-382)
Urbana, IL 61801

Dear Prof. Ando:

Last week, we received a proposal to establish a new concentration "Actuarial Science and Risk Management" in the PhD in Mathematics, College of Liberal Arts and Sciences.

Based upon the documents received and reviewed by Tim Cole, it is our belief that there will be no significant impact on collection development, instruction, or other operations in the University Library. We already collect aggressively to support actuarial science and are relatively comprehensive in our collection in this area, even in the absence of a formal PhD program. As Tim noted, "we may find a couple of more actuarial journal titles we can buy, or we might find one or two extra monographs to purchase every year, but I really don't think it will change our collection development profile substantively. I also don't see substantive increase in public service activity because of this proposal."

If additional services or materials are required as the program develops, we will be happy to discuss those needs as they emerge. But, it is our belief that this added concentration will have no appreciable impact on the library's services.

Sincerely,

John P. Wilkin
Juanita J. and Robert E. Simpson
Dean of Libraries and University Librarian

e-cc: Tim Cole
         Runhuan Feng
         Thomas Teper

February 21, 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 establish a graduate concentration in Actuarial Science and Risk Analytics.

Sincerely,

Kathryn A. Martensen
Assistant Provost

Enclosures

c: A. McKinney
    K. Carney
    R. Laugesen
    R. Feng
    J. Hart
    A. Edwards

College of Liberal Arts and Sciences
Office of the Dean

2090 Lincoln Hall
702 S. Wright Street, MC-448
Urbana, IL 61801

November 21, 2016

Wojtek Chodzko-Zajko
Dean, Graduate College
204 Coble Hall MC-322

Dear Dean Chodzko-Zajko:

The Committee on Courses and Curricula, on behalf of the Faculty of the College of Liberal Arts and Sciences has voted to approve the following proposal:

Establish a New Concentration "Actuarial Science and Risk Analytics" within the PhD in Mathematics (Department of Mathematics, College of Liberal Arts and Sciences)

Please let me know if you have any questions on this proposal. This proposal is now ready for review by the Graduate College for proposed implementation upon approval.

Sincerely,

Karen M Carney

Karen M. Carney
Associate Dean

enclosure
C: Professor Matthew Ando
      Professor Richard Laugesen
      Professor Runhuan Feng