: PREDICTIVE ANALYTICS AND RISK MANAGEMENT, MS

In Workflow

1. U Program Review (dforgacs@illinois.edu; eastuby@illinois.edu; aledward@illinois.edu)
2. 1257 Head (tyson@illinois.edu)
3. KV Dean (las-catalog@illinois.edu)
4. University Librarian (jpwilkin@illinois.edu)
5. Grad_College (agrindly@illinois.edu; jch@illinois.edu; lowry@illinois.edu)
6. Provost (kmartens@illinois.edu)
7. Senate EPC (bjlehman@illinois.edu; moorhouz@illinois.edu; kmartens@illinois.edu)
8. Senate (jtempel@illinois.edu)
9. U Senate Conf (none)
10. Board of Trustees (none)
11. IBHE (none)
12. DMI (eastuby@illinois.edu; aledward@illinois.edu; dforgacs@illinois.edu)

Approval Path

1. Tue, 19 Jan 2021 21:59:56 GMT
   Deb Forgacs (dforgacs): Approved for U Program Review
2. Thu, 21 Jan 2021 00:03:54 GMT
   Jeremy Tyson (tyson): Approved for 1257 Head
3. Thu, 21 Jan 2021 00:26:03 GMT
   Kelly Ritter (ritterk): Approved for KV Dean
4. Thu, 21 Jan 2021 01:23:12 GMT
   John Wilkin (jpwilkin): Rollback to KV Dean for University Librarian
5. Fri, 22 Jan 2021 16:14:42 GMT
   Amy Elli (amyelli): Approved for KV Dean
6. Fri, 22 Jan 2021 16:38:44 GMT
   John Wilkin (jpwilkin): Approved for University Librarian
7. Thu, 25 Feb 2021 19:46:10 GMT
   Allison McKinney (agrindly): Approved for Grad_College
8. Thu, 25 Feb 2021 21:57:00 GMT
   Kathy Martensen (kmartens): Approved for Provost
9. Thu, 25 Feb 2021 22:26:07 GMT
   Kathy Martensen (kmartens): Rollback to Provost for Senate EPC
10. Fri, 09 Apr 2021 15:51:22 GMT
    Kathy Martensen (kmartens): Approved for Provost

New Proposal

Date Submitted:Tue, 19 Jan 2021 21:49:10 GMT

Viewing:: Predictive Analytics and Risk Management, MS

Changes proposed by: Kelly Ritter

Proposal Type

Proposal Type:

Major (ex. Special Education)

Proposal Title:

If this proposal is one piece of a multi-element change please include the other impacted programs here.*example: A BS revision with multiple concentration revisions*

Creation of a Master of Science degree in Predictive Analytics and Risk Management and corresponding concentrations(keys 1022, 1023, 1024) within the Department of Mathematics in the College of Liberal Arts & Sciences

EP Control Number

EP.21.127

Official Program Name

Predictive Analytics and Risk Management, MS

Effective Catalog Term

Fall 2022

Sponsor College

Liberal Arts & Sciences

Sponsor Department

Mathematics

Sponsor Name

Runhuan Feng, Professor of Mathematics and Director of Actuarial Science

Sponsor Email

rfeng@illinois.edu

College Contact

Kelly Ritter

College Contact Email

ritterk@illinois.edu

Program Description and Justification

Provide a *brief* **description and justification of the program, including highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.**

This proposal seeks to establish a new Master of Science degree in Predictive Analytics and Risk Management with two concentrations:
• Financial and Insurance Analytics;
• Enterprise Risk Management.
This LAS degree program will be housed in the Department of Mathematics, with additional courses for the program being offered by the Department of Statistics in the College of Liberal Arts and Sciences, and by the Department of Finance in the Gies College of Business. All the administrative staff members will be housed in the Department of Mathematics. The Director of the PARM program will be appointed in the Department of Mathematics.

Policy and budgetary oversight will be handled by a committee appointed by all participating departments, whose recommendations will be subject to review and approval by the PARM Director.

As disruptive technologies emerge such as big data, artificial intelligence, predictive analytics, and autonomous vehicles, it has become clear that it is no longer sufficient for the financial and insurance industries to rely on a grouping of accountants, actuaries, statisticians and computer scientists with separate skill sets. Rather, the industry desires employees who understand the business context, have a broad view of enterprise risk management, and possess deep knowledge of analytics in order to bring forth creative solutions based on insights gained from data analysis. Successful professionals must also develop the soft skills to communicate effectively with management and non-experts, and bring innovative ideas to execution. However, traditional master programs are often either solely business focused or primarily technical preparation. The predictive analytics & risk management program aims to fill this important gap in the academic training, providing an interdisciplinary platform to utilize educational resources across campus at the University of Illinois to offer a rich experience best suited for career development in the financial service and insurance industries.

The two concentrations are proposed to suit individual needs for professional development. The financial and insurance analytics concentration is suitable for candidates who aspire to become technically advanced professionals with strong modeling and data analytics skills. We expect students in this concentration to come with a background in Mathematics, Statistics or Operations Research, etc. The enterprise risk management concentration is intended for candidates interested in managing advanced analytics technology from high level roles. Students in this concentration are expected to come with a background in Business Administration, Finance, Insurance and Risk Management, etc. Students in these concentrations have at least three courses in common and possibly more depending on their choices of electives. However, different concentrations account for diverse backgrounds and professional goals.

It is anticipated that this degree will become a preferred choice for a substantial subset of the nearly 1,000 annual applicants for the MS Statistics degree programs and MS Actuarial Science program. In particular, those with special interests in predictive analytics for finance and insurance industries would be especially attracted. Admission will be coordinated with those programs to maximize the students pool. Additionally, we expect to have many applicants who recently graduated from actuarial science programs at UIUC and other institutions, and other applicants with degrees in finance. We also expect to target working actuaries who are interested in furthering their education in predictive analytics, which is a major push within the Society of Actuaries.

Corresponding Degree

MS Master of Science

Is this program interdisciplinary?

No

Academic Level

Graduate

Will you admit to the concentration directly?

Yes

Is a concentration required for graduation?

Yes

CIP Code

520215 - Risk Management.

Is This a Teacher Certification Program?

No

Will specialized accreditation be sought for this program?

Yes

Describe the plans for seeking specialized accreditation:

Professional Risk Managers' International Association (PRMIA) Risk Accreditation Program
https://prmia.org/Public/PRM/PRM_Exam_Exemptions__University_Accreditation.aspx

Institutional Context

University of Illinois at Urbana-Champaign

Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built.

Explain the nature and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).

This new MS degree program will provide rigorous, modern and foundational education in an area of major importance in society. It will produce graduates who have a deep and balanced knowledge of data science, actuarial science and finance, to expertly address problems of predictive analytics for risk management. Strong data science education coupled with a deep knowledge of financial principles will provide a systematic educational foundation for future leaders in financial industries.
Some objective outcomes that will assist in measuring the quality of the program will be success in job placement and the number of waivers for professional exams achieved by certification in the Professional Risk Managers' Association.

University of Illinois

Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.

State of Illinois is home to the nation's top insurers. Illinois insurance companies, agents and brokers fuel the economy with quality jobs, revenue and investments. University of Illinois has a long and proud history of producing actuaries, insurance and risk management professionals for the insurance industry with graduates from Mathematics, Statistics and Finance. This new program enables the university to keep abreast with the insurance industry's changing expectations and needs for talents. Graduates from this program are expected to fill a gap in the market for specialized predictive analysts.

State of Illinois

Indicate which of the following goals of the Illinois Board of Higher Education's Strategic Initiative are supported by this program: (choose all that apply)

Educational Attainment - increase educational attainment to match the best-performing states.
High Quality Credentials to Meet Economic Demand - Increase the number of high-quality post-secondary credentials to meet the demands of the economy and an increasingly global society.

Describe how the proposed program supports these goals.

The program is expected to apply for accreditation program of Professional Risk Managers' International Association (PRMIA), which sets international standards for graduate level education in risk management. If successful, students graduated from the proposed PARM program would be waived for Professional Risk Management Designation exams I and II. Students would be on fast track to become credentialed, which would give

them comparative advantages when going to the job market. The PARM program is well positioned to meet the increasing demand for professional risk managers as well as predictive analytics professionals by offering pre-professional training and solid scientific foundation.

https://prmia.org/Public/Learning/University-Alliances/exemptions-university.aspx

The PARM curriculum is innovative in the sense that it combines data science training with finance and insurance oriented coursework. There are also components of business focused case studies that allow students to apply theory to practice. As the home to many of the country's largest insurers and the financial derivative market, Illinois has a strong need for new generations of risk managers who are not only well versed in classic business focused risk curriculum but also possess strong in data analytic skills. The PARM is one of the very few such programs in the state of Illinois that can meet this growing needs in the market. The PARM program can greatly contribute to the economic development of Illinois' financial industry by offering high caliber job candidates.

Admission Requirements

Desired Effective Admissions Term

Fall 2022

Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students.

Applicants must have earned at least a bachelor's degree from a regionally accredited college in the United States or a comparable degree from a recognized institution of higher learning abroad. Minimum requirements on GPA and English proficiency are expected to be consistent with those of graduate college.

Describe how critical academic functions such as admissions and student advising are managed.

The Assistant or Associate Director of the PARM program is expected to pre-screen candidates. An admission committee that consists of faculty members teaching for the PARM program and is led by a faculty director will screen and admit candidates. Staff members will proceed and work with the Graduate College to finalize admission decisions.

Enrollment

Number of Students in Program (estimate)

Year One Estimate

20

5th Year Estimate (or when fully implemented)

50

Estimated Annual Number of Degrees Awarded

Year One Estimate

15

5th Year Estimate (or when fully implemented)

50

What is the matriculation term for this program?

Fall

What is the typical time to completion of this program?

1 year to 1.5 years

What are the minimum Total Credit Hours required for this program?

32

Delivery Method

This program is available:

On Campus

Budget

Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?

No

Additional Budget Information

Department of Mathematics is expected to hire a program director and a full-time program specialist prior to receiving the first class of students. Each department is expected to dedicate one full-time faculty member or the equivalent of several part-time faculty members to teach courses for this program. We do not expect to see significant change to their current number of faculty, class size, teaching loads. Admission, academic and career advising, and other administrative support will be provided by the Predictive Analytics and Risk Management office to be housed in the Department of Mathematics.

For the initial year of the program, the campus grant will assist in paying for a faculty director, an academic professional, and some instruction from faculty. The tuition generated from the Predictive Analytics and Enterprise Risk Management degree will then be utilized to hire faculty. Some of these faculty will be directly involved in the instruction of the required courses, and other will be used to help reallocate tenure stream faculty to these courses in the master's degree. No functions or programs will need to be cut to support this degree.

Attach File(s)

PARM Program Financial Operations.docx

Resource Implications

Facilities

Will the program require new or additional facilities or significant improvements to already existing facilities?

No

Technology

Will the program need additional technology beyond what is currently available for the unit?

No

Non-Technical Resources

Will the program require additional supplies, services or equipment (non-technical)?

No

Resources

For each of these items, be sure to include in the response if the proposed new program or change will result in replacement of another program(s). If so, which program(s), what is the anticipated impact on faculty, students, and instructional resources? Please attach any letters of support/ acknowledgement from faculty, students, and/or other impacted units as appropriate.

Faculty Resources

Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

We do not anticipate major changes in class sizes resulting from enrollment of these students in elective courses, and they can be absorbed into our current system. However, we do anticipate that several new sections will be required for many of the required courses. It appears that one new section per year will need to be offered in ASRM 410, ASRM 552, ASRM 533, ASRM 539, STAT 431, STAT 432, STAT 480, FIN 526, FIN 530, FIN 567. This implies that roughly one new faculty member, whether specialized or tenure stream, will be needed in each of the three participating departments. We also anticipate requiring an additional 9 50% TAs for the 9 new course sections we will need. As spelled out in the Resources section, these will be expenses covered by the tuition.

Library Resources

Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

Current collections and services are adequate for the proposed program as existing courses from MATH, STAT and Finance are being used in the curricula.

Instructional Resources

Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?

No

Does the program include other courses/subjects impacted by the creation/revision of this program?

No

Financial Resources

How does the unit intend to financially support this proposal?

The interdisciplinary nature of this degree requires that Mathematics reach tuition sharing agreements with collaborating departments, Statistics and Finance. After paying for some fixed costs, the remaining revenue will be split across departments according to the number of hours of instruction performed by each department. The existing arrangements allow for growth in the program to be supported by the resulting growth in tuition income. A more detailed financial analysis is given below.

As explained in the Justification section, we expect a large pool of applicants to ensure the admission of a sufficiently large number of high caliber candidates so that the costs of running the program are covered.

Below is a brief analysis of the breakeven point, and revenue depending on enrollment. We assume an arrangement within LAS that directs 70% of the net tuition to the Math department, which will then be shared with the Statistics and Finance departments in proportion to the number of hours of instruction after subtracting some fixed costs. Annual expenditures are assumed to be a 15K stipend for the program director, 60K for a 100% academic professional who will be involved with advising, admissions, and job placement, 35K for a civil service employee and 330K for instructors of additional sections that will be required. We assume an expense of 90K for 50% TAs who will serve in these extra sections and 114K for other expenses such as travel, guest speaker, marketing, costs in developing online courses and other items. That comes to a total of 644K in annual expenses. Revenue from tuition is based on an approximate base rate of 27.412K for nonresident students and 12.688K for Illinois residents, and a tuition differential for all students. The tuition differential amount is being reviewed within the College and will be requested with the AY22-23 tuition request. We assume that 80 percent will be nonresident and 20 percent will be residents. We further assume that 50% of students will spend two semesters in the program, and 50% will spend three semesters. Given these assumptions, the total number of students required for the departments to break even is 25.

The differential tuition on top of the base graduate tuition is intended to fund a Predictive Analytics Education and Research Innovation Initiative. The objective of the funding is to make more courses available online and to cover costs of industry speakers to campus, providing individualized career coaching services, etc, which are additional services not available in existing MS programs in the Departments of Mathematics and Statistics. This may also be used to support research innovations and collaborations among the participating departments' faculty and students.

Will the unit need to seek campus or other external resources?

Yes

If yes, please provide a summary of the sources and an indication of the approved support.

The program is expected to require a differential tuition in addition to standard tuition graduate rate. The tuition differential amount is being reviewed within the College and will be requested with the AY22-23 tuition request. The requested tuition for this new program will be consistent with other Graduate College programs with Illinois LAS disciplines at its core. In comparison to those graduate programs at highly ranked schools for programs in Risk Management and Analytics this new joint program offers real economic incentives for students in considering this new opportunity. Comparisons are admittedly not perfect, in reviewing both the degree offered and content. It appears that our tuition costs are generally 15% lower than comparable programs.

Attach letters of support

Actuarial Master Statistics LoS Dec 2020.pdf
Actuarial Master FIN_Memo_of_support_Dec2020.pdf
MS PARM Self-Supporting Request.pdf

Are you seeking a change in the tuition rate or differential for this program?

Yes

If yes, please enter your college budget office contact information and have them contact provostbudget@illinois.edu for next steps.

The program is expected to require a $3,000 differential tuition in addition to standard tuition graduate rate. The tuition for this new program is consistent with other Graduate College programs with Illinois LAS disciplines at its core. In comparison to those graduate programs at highly ranked schools for programs in Risk Management and Analytics this new joint program offers real economic incentives for students in considering this new opportunity. Comparisons are admittedly not perfect, in reviewing both the degree offered and content. It appears that our tuition costs are generally 15% lower than comparable programs.

Is this program requesting self-supporting status?

Yes

Market Demand

What market indicators are driving this proposal? If similar programs exist in the state, describe how this program offers a unique opportunity for students:

The insurance and financial services industries have seen increased use of predictive analytics in nearly all areas of practice. Nearly all major insurance and consulting firms established Analytics offices or departments over the last few years. Both Society of Actuaries and Casualty Actuarial Society (CAS) are rolling out professional exams on data analytics. The CAS is also introducing a new professional credential called "Certified Specialist in Predictive Analytics" (CSPA). However, data science is advancing more rapidly than previous attempts by actuarial and financial analyst professions to adapt. This gives rise to a nascent profession of Predictive Analytics.
There are several similar programs offered by other universities, such as Master of Science in Predictive Analytics at Northwestern University. Most existing programs target students in broad areas including marketing, healthcare, finance and resource management. While the proposed program has the potential to expand to other areas, the current strategy is to leverage the university's strength and international reputation in finance and actuarial science and to focus on financial services and insurance industries.

What type of employment outlook should these graduates expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.

According to Burtch Works, an executive recruiting firm, predictive analytics professionals are employed in a variety of industries, such as financial services, marketing, healthcare, etc., and there will continue to be strong demand in these sectors. See table in Appendix A.
Risk management, on the other hand, is a very established profession. Risk management seek to identify and analyze the risks associated with a company's business operations and develop action plans for managing the risks. Risk management professionals can play different functions for corporations, such as risk analyst, risk manager, risk management consultant, risk control supervisor, director of corporate risk management and chief risk officer, etc. The financial services sector will continue to be the strongest recruiter for risk management professionals due to increased regulation and public sector scrutiny around the world. There is a growing shift in demand to have professionals with data analytics skills and who can glean information about risks from models and provide insights and advice to organizations. The proposed new program offers an integrated education on both risk management and predictive analytics, which can prepare students for the changing needs of the risk management profession.

What resources will be provided to assist students with job placement?

The academic professional hired full time for this program is dedicated to provide career counseling and advising services to students in this program. We also intend to develop a summer internship program where students will be matched with potential employers. A pilot program was successfully implemented with existing undergraduate students in summer 2019. Many students received full-time job opportunities they interned with. We expect to use the connections developed for this pilot program and expand it to master's students from the PARM degree program.

Program Regulation and Assessment

Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning. (Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable).

This program prepares students for the nascent profession of predictive analytics; it provides background and skill sets for data analytics with focus on financial and insurance industries. A student successfully finishing the program will typically have acquired a broad foundation of machine learning and predictive modeling techniques to forecast outcomes and glean valuable insights that can lead to better-informed business and investment decisions.

The assessment of the above-stated learning objectives will include:
o the job placement/graduate school acceptance rates
o feedback from employers
o graduate satisfaction surveys
These assessments will be conducted on an annual basis. We conduct exit surveys on all students each year, which should provide data on graduate students' job placement and graduate school acceptance rates. On the survey we will design questions to assess student's overall evaluation of these learning objectives. The curriculum was developed in close collaboration with industry partners. We expect to maintain close relationship with them and seek their feedback on the quality of our graduates on a regular basis.

Is the career/profession for graduates of this program regulated by the State of Illinois?

No

Program of Study

"Baccalaureate degree requires at least 120 semester credit hours or 180 quarter credit hours and at least 40 semester credit hours (60 quarter credit hours) in upper division courses" (source: https://www.ibhe.org/assets/files/PrivateAdminRules2017.pdf). For proposals for new bachelor's degrees, if this minimum is not explicitly met by specifically-required 300- and/or 400-level courses, please provide information on how the upper-division hours requirement will be satisfied.

All proposals must attach the new or revised version of the Academic Catalog program of study entry. Contact your college office if you have questions.

For new programs, attach Program of Study

ACADEMIC CATALOG ENTRY MS in Predictive Analytics and Risk Management.docx
Appendix A MS in Predicitve Analytics and Risk Management.docx
MS in Predictive Analytics and Risk Manangement Proposal REV 111620.doc

Catalog Page Text

Catalog Page Text: Description of program for the catalog page. This is not official content, it is used to help build the catalog pages for the program. Can be edited in the catalog by the college or department.

This proposed new degree program is designed to respond to a large and growing demand for professionals with expertise in modern statistical techniques combined with an understanding of risk management in a wide range of industries including insurance, consulting, investment, pension, healthcare, banking and financial services. This program combines training in modern statistical methods with actuarial science principles and financial risk management. The coursework is intended for students who have the prerequisite quantitative background to train for careers in predictive analytics for insurance and other financial settings by providing a multidisciplinary and integrated program. Core requirements include courses from three disciplines, a course in financial risk management, courses in risk management and predictive analytics from an actuarial science perspective, and training in statistical machine learning, big data techniques, and Bayesian statistical methods. Related courses from the

three disciplines may then be chosen as electives for students to reach their individualized educational goals. Courses will be scheduled so that students may complete the 32-hour program in one academic year. Each concentration requires 12 hours of common core courses, organized around three broad areas of expertise, including a case study course. Each concentration also requires 12 hours of related area coursework specific to the concentration, plus an additional 8 hours of electives from a prescribed list included in this proposal. At least 12 hours must be taken at the 500 level.

Statement for Programs of Study Catalog

Code	Title	Hours
Core Requirements (12 hours):		
FIN 530	Foundations in Risk Management	2
ASRM 410	Investments and Financial Markets	4
ASRM 539	Risk Analytics and Decision Making	2
ASRM 552	Predictive Analytics	4

EP Documentation

DMI Documentation

Program Reviewer Comments

Deb Forgacs (dforgacs) (Tue, 19 Jan 2021 21:38:49 GMT): Rollback: Requested.

John Wilkin (jpwilkin) (Thu, 21 Jan 2021 01:23:12 GMT): Rollback: Hi Kelly. On these where the Library's resources and subject specialists are sufficient for the program, can we say "current collections and services are adequate for the proposed program" or something similar? Previously, we had people in library departments review proposals, which feels like overkill, but it would be better for our collective records if we asserted something about the adequacy of the current resources.

Kathy Martensen (kmartens) (Thu, 25 Feb 2021 22:26:07 GMT): Rollback: Budget office notice pending.

Kathy Martensen (kmartens) (Fri, 09 Apr 2021 15:51:19 GMT): Editorial changes to Financial Resources- fin support plans and tuition rate explanation made at request of Budget and Resource Planning Office.

Key: 1022

ILLINOIS

GRADUATE COLLEGE

110 Coble Hall, MC-322
801 S. Wright St.
Champaign, IL 61820

PROGRAM TUITION WAIVER POLICY PROPOSAL

Proposals to establish or revise tuition waiver policy for a graduate program will follow a shared governance approval process (Department, School, College, Graduate College).

Definitions of Tuition Waiver Policy Designations:

Traditional Programs. Programs either designated as generating **full or base-rate** tuition waivers. Base rate waivers waives only the Resident Graduate Base tuition amount. Non-Residents or students in a program with an additional tuition differential will be responsible for the remaining portion of tuition.

Reimbursable Programs. Programs identified as programs that would be reimbursed from an appointing unit outside their academic college.

Cost-recovery and self-supporting programs. Students in approved cost-recovery and self-supporting programs are not eligible to receive tuition and fee waivers except statutory waivers. Students in these programs are not eligible to hold a waiver generating graduate appointment (Assistantship or Fellowship). Full time employees may be admitted to these programs, but their employee waiver is not eligible for use towards a program with this designation.

Additional information related to these tuition waiver designations can be found here:
http://www.grad.illinois.edu/gradhandbook/2/chapter7/tuition-waivers#otherprovisions.

PROGRAM INFORMATION

COLLEGE OR SCHOOL: Liberal Arts and Sciences

PROGRAM(s) (Include Program Codes if applicable):
 Predictive Analytics and Risk Management

REQUESTED DESIGNATION (Check box next to desired designation type):

Self-Supporting

Comments:

JUSTIFICATION: On a separate sheet, please address the following.

1. Describe the reasons for this request and explain: (a) the pros and cons of the classification requested, and (b) how the requested classification will benefit and not adversely affect the academic quality of the program.

2. What type of financial assistance will be offered to students in the program?

3. Has this program had past practice of offering graduate assistantships? If so, please describe.

4. What provisions will be made to communicate the new classification to prospective and newly admitted students?

APPROVALS: (May use Adobe Signature or print and sign the document)

Department Executive Officer Signature and Date: Jeremy Tyson
Digitally signed by Jeremy Tyson
DN: cn=Jeremy Tyson, o=University of Illinois at Urbana-Champaign, ou=Department of Mathematics, email=tyson@illinois.edu, c=US
Date: 2021.02.17 17:19:12 -06'00'

Disciplinary College Signature and Date: Matthew Ando
Digitally signed by Matthew Ando
Date: 2021.02.23 08:48:00 -06'00'

Graduate College Signature and Date: Allison McKinney
Digitally signed by Allison McKinney
Date: 2021.02.25 13:33:41 -06'00'

Responses to questions: Program Tuition Waiver Policy Proposal
Predictive Analytics and Risk Management MS

1. Describe the reasons for this request and explain: (a) the pros and cons of the classification requested, and (b) how the requested classification will benefit and not adversely affect the academic quality of the program.

   (a) The self-financing program offers flexible full-time and part-time pathways to academically qualified working adults. Such a program will give our department more flexibility to hire industrial professionals to teach part-time and to adapt to changes quickly to address training needs of the predictive analytics profession. The self-supporting program will not drain resources of the Mathematics Department or have any adverse effect on regular programs in the department.

   Because self-financing programs are not supported by state funds, full program costs, including but not limited to faculty instructional costs, program support costs, student services costs, and overhead, will be covered by student fees or other non-state funds. We have carried out detailed budgetary planning to ensure that the program is able to recover all costs from non-state sources.

   (b) We expect that many faculty members of our regular Masters program will teach some coursework for the proposed program. They are expected to have the same standards of quality as regular programs. The self-supporting classification will also give the program the flexibility to hire industry professionals to teach relevant coursework that enhance student employability and competitiveness in the job market. This is a unique advantage not affordable in regular programs. The appointment of a faculty director with years of experience in running a regular Masters program also ensures that the program will meet the highest standards of quality as other regular programs.

2. What type of financial assistance will be offered to students in the program?

   The program is not expected to offer financial assistance to students.

3. Has this program had past practice of offering graduate assistantships? If so, please describe.

   This is a brand-new program that has not existed on the Urbana-Champaign campus before.

4. What provisions will be made to communicate the new classification to prospective and newly admitted students?

   The self-supporting status of the program will be described in the program marketing materials. The program targets working adults who desire to come back to campus to improve their data analytics skills, or international students with an undergraduate degree from a different field. The program can be viewed as the equivalent of the MBA in the field of data analytics. Like most such programs in peer institutions, most students understand that such a program prepares them for professional career paths and do not require graduate assistantship.

Department of Statistics
101 Illini Hall
725 South Wright Street
Champaign, IL 61820

December 3, 2020

Dear Runhuan,

I am very pleased to co-sponsor this exciting proposal for Predictive Analytics and Risk Management MS programs with concentrations in financial and insurance analytics and enterprise risk management. The Statistics Department will benefit from this collaboration with Actuarial Science and Finance, and we recognize the expected increased load on particular courses. My understanding of the financial arrangement is that tuition received by the Math Department will be divided with the participating units in proportion to the number of hours of instruction after subtracting some fixed costs that are detailed in the proposal.

Sincerely,

Bo Li
Professor and Chair
Department of Statistics

Department of Finance
340 Wohlers Hall
1206 South Sixth Street
Champaign, IL 61820

Louis K.C. Chan
Hoeft Professor and Department Chair

MEMORANDUM

12 December 2020

TO WHOM IT MAY CONCERN

On behalf of the Department of Finance, Gies College of Business, I support the proposal for a graduate degree in Predictive Analytics and Risk Management. I understand that the proposed LAS degree program will be jointly administered by the Departments of Mathematics and Statistics in the College of Liberal Arts and Sciences, and the Department of Finance in the Gies College of Business. All the administrative staff members will be housed in the Department of Mathematics. Policy and budgetary oversight will be provided by a committee appointed by all participating departments.

Louis K. C. Chan
Hoeft Professor and Business and Chair, Department of Finance
Gies College of Business
University of Illinois Urbana-Champaign

ILLINOIS

Proposal for new curricula (degree, major, concentration, minor)

Submit completed proposals via email to Associate Dean Kelly Ritter (ritterk@illinois.edu). Please obtain Executive Officer and School Director (if applicable) approval via email and forward with the proposal to LAS.

Proposal Title: Establish a New Master of Science degree in Predictive Analytics and Risk Management with two concentrations: (1) Financial and Insurance Analytics and (2) Enterprise Risk Management within the Department of Mathematics in the College of Liberal Arts and Sciences

For proposals with concentrations- Students are expected to be admitted directly to the concentrations. A concentration is required for graduation. There is an option for students to switch concentrations.

Proposed effective date: *(Proposals may not be implemented until they go through all necessary levels of approval. Proposed changes may not be publicized as final on any web sites, printed documents, etc. until written confirmation of final approval is issued. For LAS units, a fall semester effective term for all curricula will be requested, please indicate the proposed year).*

Fall 2022

Sponsor(s):

Runhuan Feng, Professor of Mathematics and Director of Actuarial Science, 330-5630, rfeng@illinois.edu;
Jeffrey A. Douglas, Professor of Statistics, 244-7302, jeffdoug@illinois.edu;
Louis K.C. Chan, Professor of Finance and Department Chair and Hoeft Professor of Business, 333-6391, l-chan2@illinois.edu.

College contact: Kelly Ritter, Associate Dean for Curricula and Academic Policy, College of Liberal Arts and Sciences, ritterk@illinois.edu

PROGRAM DESCRIPTION and JUSTIFICATION

1) **Provide a brief description but concise description of your proposal.** For example, if proposing revisions to a curriculum, state specifically what is changing. Where applicable, note whether stated program changes include additional requirements in the form of prerequisite courses. Requests for curriculum revisions must be accompanied by a table which clearly outlines the current requirements and the proposed revisions. This information may be submitted as an appendix. See Appendix A for an example. Please provide pertinent information only.

This proposal seeks to establish a new *Master of Science degree in Predictive Analytics and Risk Management* with two concentrations:

- Financial and Insurance Analytics;
- Enterprise Risk Management.

This LAS degree program will be jointly administered by the Departments of Mathematics and Statistics in the College of Liberal Arts and Sciences, and the Department of Finance in the Gies College of Business. All the administrative staff members will be housed in the Department of Mathematics. The Director of the PARM program will be appointed in the Department of Mathematics. Policy and budgetary oversight will be handled by a committee appointed by all participating departments, whose recommendations will be subject to review and approval by the PARM Director.

2) **Provide a justification of the program**, including how your unit decided to create this program, highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.

As disruptive technologies emerge such as big data, artificial intelligence, predictive analytics, and autonomous vehicles, it has become clear that it is no longer sufficient for the financial and insurance industries to rely on a grouping of accountants, actuaries, statisticians and computer scientists with separate skill sets. Rather, the industry desires employees who understand the business context, have a broad view of enterprise risk management, and possess deep knowledge of analytics in order to bring forth creative solutions based on insights gained from data analysis. Successful professionals must also develop the soft skills to communicate effectively with management and non-experts, and bring innovative ideas to execution. However, traditional master programs are often either solely business focused or primarily technical preparation. The predictive analytics & risk management program aims to fill this important gap in the academic training, providing an interdisciplinary platform to utilize educational resources across campus at the University of Illinois to offer a rich experience best suited for career development in the financial service and insurance industries.

The two concentrations are proposed to suit individual needs for professional development. The financial and insurance analytics concentration is suitable for candidates who aspire to become technically advanced professionals with strong modeling and data analytics skills. We expect students in this concentration to come with a background in Mathematics, Statistics or Operations Research, etc. The enterprise risk management concentration is intended for candidates interested in managing advanced analytics technology from high level roles. Students in this concentration are expected to come with a background in Business Administration, Finance, Insurance and Risk Management, etc. Students in these concentrations have at least three courses in common and possibly more depending on their choices of electives. However, different concentrations account for diverse backgrounds and professional goals.

It is anticipated that this degree will become a preferred choice for a substantial subset of the nearly 1,000 annual applicants for the MS Statistics degree programs and MS Actuarial Science program. In particular, those with special interests in predictive analytics for finance

and insurance industries would be especially attracted. Admission will be coordinated with those programs to maximize the students pool. Additionally, we expect to have many applicants who recently graduated from actuarial science programs at UIUC and other institutions, and other applicants with degrees in finance. We also expect to target working actuaries who are interested in furthering their education in predictive analytics, which is a major push within the Society of Actuaries.

3) In addition, please provide an answer as to how your undergraduate degree (120 hours of coursework) will satisfy this requirement: IBHE requires that all degree programs contain at least 40 credit hours in upper division courses as part of their overall degree. Not all 40 hours need to be in your major. Simply state how many of those 40 hours are achieved in your major. Upper division courses have been described as 300- and 400- level coursework and some 200-level courses in which multiple prerequisites are required.

Is this program interdisciplinary? Yes / No   If yes, list department.

Departments of Mathematics, Statistics and Finance

 If a proposal for a concentration-

>   **will you admit to the concentration directly?** Yes / No

>   **is a concentration required for graduation?** Yes / No

Will specialized accreditation be sought for this program? Yes / No   If yes, describe plans for seeking accreditation.

Professional Risk Managers' International Association (PRMIA) Risk Accreditation Program

https://prmia.org/Public/PRM/PRM_Exam_Exemptions_-_University_Accreditation.aspx

INSTITUTIONAL CONTEXT (new majors and degrees ONLY)

University of Illinois at Urbana-Champaign
Mission: The University of Illinois at Urbana-Champaign is charged by our state to enhance the lives of the citizens in Illinois, across the nation and around the world through our leadership in learning, discovery, engagement and economic development.

1) Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built. Also, explain the nature and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).

University of Illinois
University of Illinois' mission: The University of Illinois will transform lives and serve society by education, creating knowledge and putting knowledge to work on a large scale and with excellence.

This new MS degree program will provide rigorous, modern and foundational education in an area of major importance in society. It will produce graduates who have a deep and balanced knowledge of data science, actuarial science and finance, to expertly address problems of predictive analytics for risk management. Strong data science education coupled with a deep knowledge of financial principles will provide a systematic educational foundation for future leaders in financial industries.

Some objective outcomes that will assist in measuring the quality of the program will be success in job placement and the number of waivers for professional exams achieved by certification in the Professional Risk Managers' Association.

2) Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.

State of Illinois
The Public Agenda for Illinois Higher Education is a planning blueprint for the State of Illinois to direct state policies and resources to the higher education and career needs of Illinois residents and to address the current and future economic needs of the state.

State of Illinois is home to the nation's top insurers. Illinois insurance companies, agents and brokers fuel the economy with quality jobs, revenue and investments. University of Illinois has a long and proud history of producing actuaries, insurance and risk management professionals for the insurance industry with graduates from Mathematics, Statistics and Finance. This new program enables the university to keep abreast with the insurance industry's changing expectations and needs for talents. Graduates from this program are expected to fill a gap in the market for specialized predictive analysts.

3) Indicate which of the following goals of the Illinois Board of Higher Education's Strategic Initiative are supported by this program: (choose all that apply)
- ☐ Educational Attainment - increase educational attainment to match the best-performing states.
- ☐ College Affordability - ensure college affordability for students, families, and taxpayers.
- ☐ X High Quality Credentials to Meet Economic Demand - Increase the number of high-quality post-secondary credentials to meet the demands of the economy and an increasingly global society.
- ☐ X Integration of Educational, Research and Innovation Assets - Better integrate Illinois' educational, research and innovation assets to meet economic needs of the state and its regions.

4) Describe how the proposed program supports the goals above:

The program is expected to apply for accreditation program of Professional Risk Managers' International Association (PRMIA), which sets international standards for graduate level education in risk management. If successful, students graduated from the proposed PARM program would be waived for Professional Risk Management Designation exams I and II. Students would be on fast track to become

credentialed, which would give them comparative advantages when going to the job market. The PARM program is well positioned to meet the increasing demand for professional risk managers as well as predictive analytics professionals by offering pre-professional training and solid scientific foundation.

https://prmia.org/Public/Learning/University-Alliances/exemptions-university.aspx

The PARM curriculum is innovative in the sense that it combines data science training with finance and insurance oriented coursework. There are also components of business focused case studies that allow students to apply theory to practice. As the home to many of the country's largest insurers and the financial derivative market, Illinois has a strong need for new generations of risk managers who are not only well versed in classic business focused risk curriculum but also possess strong in data analytic skills. The PARM is one of the very few such programs in the state of Illinois that can meet this growing needs in the market. The PARM program can greatly contribute to the economic development of Illinois' financial industry by offering high caliber job candidates.

ADMISSION REQUIREMENTS

1) Desired admissions term: *For LAS units, a fall semester effective term for all curricula will be requested, please indicate the proposed year*

> **Fall   2022**

2) Provide a brief description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students.

Applicants must have earned at least a bachelor's degree from a regionally accredited college in the United States or a comparable degree from a recognized institution of higher learning abroad. Minimum requirements on GPA and English proficiency are expected to be consistent with those of graduate college.

3) Describe how critical academic functions such as admissions and student advising are managed.

The Assistant or Associate Director of the PARM program is expected to pre-screen candidates. An admission committee that consists of faculty members teaching for the PARM program and is led by a faculty director will screen and admit candidates. Staff members will proceed and work with the Graduate College to finalize admission decisions.

ENROLLMENT

> **1)** Number of students in program estimates
>
> > **Year 1 estimate: 20**
> >
> > **Year 5 estimate (or when fully implemented):   50**
>
> **2)** Estimated Annual Number of Degrees Awarded (degrees, majors and concentrations ONLY)

Year 1: 15

Year 5 (or when fully implemented):   50

The estimated number of degrees awarded in the first year is lower than the number of students in the program due to the fact that some students may elect to continue with the program for more than two semesters.

3) What is the matriculation term for this program?   <mark>Fall</mark>   OR   Spring/<mark>summer</mark>/other

4) What is the typical time to completion of this program? <mark>1 year to 1.5 years</mark>

Note: grad certificates require at least 10 weeks. Other examples: BALAS= 4years, MA=2.5 years

5) What are the minimum Total Credit Hours required for this program? <mark>32</mark>

6) Delivery Method, what is the program's primary delivery method? Choose from following:

<mark>Face to Face</mark>; Online & Face to Face; Online Only; Other- specify

BUDGET

1) **Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available? If yes, please describe.**

The Department of Mathematics is expected to hire a program director and a full-time program specialist prior to receiving the first class of students. Each department is expected to dedicate one full-time faculty member or the equivalent of several part-time faculty members to teach courses for this program. We do not expect to see significant change to their current number of faculty, class size, teaching loads. Admission, academic and career advising, and other administrative support will be provided by the Predictive Analytics and Risk Management office to be housed in the Department of Mathematics.

For the initial year of the program, the campus grant will assist in paying for a faculty director, an academic professional, and some instruction from faculty. The tuition generated from the Predictive Analytics and Enterprise Risk Management degree will then be utilized to hire faculty. Some of these faculty will be directly involved in the instruction of the required courses, and other will be used to help reallocate tenure stream faculty to these courses in the master's degree. No functions or programs will need to be cut to support this degree.

2) Please provide any additional budget information needed to effectively evaluate the proposal.

Please see the attached Financial Operations document.

RESOURCE IMPLICATIONS

1) Facilities- Will the program require new or additional facilities or significant improvements to already existing facilities? If yes, please outline the specific need and Year 1 and Year 5 cost.

No

2) Technology- Will the program need additional technology beyond what is currently available for the unit? If yes, please outline the specific need and Year 1 and Year 5 cost.

We expect the impact to be negligible. Given the nature of the concentration, it is unlikely that a student without a laptop would enroll. The necessary specialized software is freely available and could be installed directly on their laptops. Access to campus clusters would be relevant, and the department has access to two campus clusters, with more being planned in cooperation with ATLAS.

3) Non-Technical Resources- Will the program require additional supplies, services or equipment (non-technical)? If yes, please outline the specific need and Year 1 and Year 5 cost.

RESOURCES

1) Faculty Resources: Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

We do not anticipate major changes in class sizes resulting from enrollment of these students in elective courses, and they can be absorbed into our current system. However, we do anticipate that several new sections will be required for many of the required courses. It appears that one new section per year will need to be offered in ASRM 410, ASRM 552, ASRM 533, ASRM 539, STAT 431, STAT 432, STAT 480, FIN 526, FIN 530, FIN 567. This implies that roughly one new faculty member, whether specialized or tenure stream, will be needed in each of the three participating departments. We also anticipate requiring an additional 9 50% TAs for the 9 new course sections we will need. As spelled out in the Resources section, these will be expenses covered by the tuition.

2) **Library Resources: Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.**

The proposed program has little to no impact on the university library's resources.

3) **Instructional Resources: Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change**? If yes, please describe.

There will be no reduction in other course offerings, programs or concentrations by either of the three departments as a result of this new program.

4) **Does this new program/proposed change result in the replacement of another program?** If yes, please specify the program.

No

5) **Does the program include any required or recommended subjects that are offered by other departments? If yes, please list the courses. Explain how these additional courses will be used by the program and provide letters of support from the departments.**

No. All of the required courses and electives are either ASRM, FIN, MATH or STAT, and the concentrations were planned by a task force with representatives from each department. We have included letters of support from Statistics and Finance.

FINANCIAL RESOURCES

1) **How does the unit intend to financially support this proposal?**

The interdisciplinary nature of this degree requires that Mathematics reach tuition sharing agreements with collaborating departments, Statistics and Finance. After paying for some fixed costs, the remaining revenue will be split across departments according to the number of hours of instruction performed by each department. The existing arrangements allow for growth in the program to be supported by the resulting growth in tuition income. A more detailed financial analysis is given below.

As explained in the Justification section, we expect a large pool of applicants to ensure the admission of a sufficiently large number of high caliber candidates so that the costs of running the program are covered.

Below is a brief analysis of the breakeven point, and revenue depending on enrollment. We assume an arrangement with LAS that directs 70% of the tuition to the Math department, which will then be shared with the Statistics and Finance departments in proportion to the number of hours of instruction after subtracting some fixed costs. Annual expenditures are assumed to be a 15K stipend for the program director, 60K for a 100% academic professional who will be involved with advising, admissions, and job placement, 35K for a civil service employee and 330K for instructors of additional sections that will be required. We assume an expense of 90K for 50% TAs who will serve in these extra sections and 114K for other expenses such as travel, guest speaker, marketing, costs in developing online courses and other items. That comes to a total of 644K in annual expenses. Revenue from tuition is based on an approximate base rate of 27.412K for nonresident students and 12.688K for Illinois residents, and a 3K tuition differential for all students.. We assume that 80 percent will be nonresident and 20 percent will be residents. We further assume that 50% of students will spend two semesters in the program, and 50% will spend three semesters. Given these assumptions, the total number of students required for the departments to break even is 25.

The 3K differential tuition on top of the base graduate tuition is intended to fund a Predictive Analytics Education and Research Innovation Initiative. The objective of the funding is to make more courses available online and to cover costs of industry speakers to campus, providing individualized career coaching services, etc, which are additional services not available in existing MS programs in the Departments of Mathematics and Statistics. This may also be used to support research innovations and collaborations among the participating departments' faculty and students.

2) **Will the unit need to seek campus or other external resources? If yes, please provide a summary of the sources and an indication of the approved support.**

This new degree program is supported by a campus-wide Investment for Growth grant awarded by the Provost's office, which will help pay for the initial year of instruction and an academic professional who will be involved with career placement, admissions, and advising on administrative matters. Additional campus or external resources would be cluster computing access and massive data sets for instruction and research. The Department of Statistics currently has a grant to further data science education on campus and is working with ATLAS to provide a cluster of servers that may be used for this program as well as other courses and data intensive educational aims. Several companies with offices in the Research Park have been supportive of MS Statistics program and provide internship opportunities for students. A notable program is the STATE FARM Modeling and Analytics Graduate Network (MAGNet) program in which MS students are hired as part-time employees and have their tuition paid. We anticipate that MAGNet will be quite interested in students from the Predictive Analytics and Risk Management degree as well.

3) *Are you seeking a change in the tuition rate or differential for this program? (degrees, majors and concentrations ONLY)? If yes, please provide information on the request. If this program requires a tuition or differential change, initiate a discussion with the LAS curricula contact, LAS budget officer, and LAS Associate Dean.*

The program is expected to require a $3,000 differential tuition in addition to standard tuition graduate rate. The tuition for this new program is consistent with other Graduate College programs with Illinois LAS disciplines at its core. In comparison to those graduate programs at highly ranked schools for programs in Risk Management and Analytics this new joint program offers real economic incentives for students in considering this new opportunity. Comparisons are admittedly not perfect, in reviewing both the degree offered and content. It appears that our tuition costs are generally 15 % lower than comparable programs.

4) **Is this program requesting self-supporting status? (degrees, majors and concentrations ONLY)? If yes, please explain.**

Yes. The entire program is expected to be self-supporting.

MARKET DEMAND

1) **What market indicators are driving this proposal? If similar programs exist in the state, describe how this program offers a unique opportunity for students.**
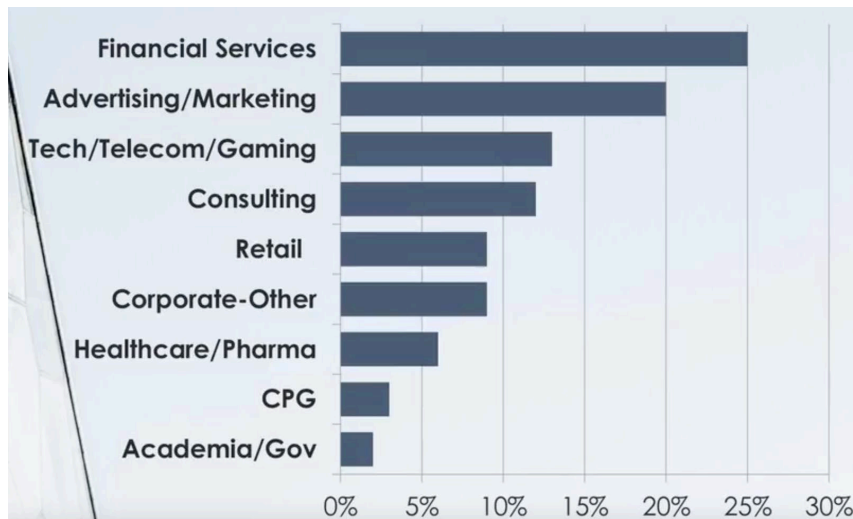
The insurance and financial services industries have seen increased use of predictive analytics in nearly all areas of practice. Nearly all major insurance and consulting firms established Analytics offices or departments over the last few years. Both Society of Actuaries and Casualty Actuarial Society (CAS) are rolling out professional exams on data

analytics. The CAS is also introducing a new professional credential called ``Certified Specialist in Predictive Analytics" (CSPA). However, data science is advancing more rapidly than previous attempts by actuarial and financial analyst professions to adapt. This gives rise to a nascent profession of Predictive Analytics.

There are several similar programs offered by other universities, such as Master of Science in Predictive Analytics at Northwestern University. Most existing programs target students in broad areas including marketing, healthcare, finance and resource management. While the proposed program has the potential to expand to other areas, the current strategy is to leverage the university's strength and international reputation in finance and actuarial science and to focus on financial services and insurance industries.

2) What type of employment outlook should these graduate expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.

According to Burch Works, an executive recruiting firm, predictive analytics professionals are employed in a variety of industries, such as financial services, marketing, healthcare, etc., and there will continue to be strong demand in these sectors.

Risk management, on the other hand, is a very established profession. Risk management seek to identify and analyze the risks associated with a company's business operations and develop action plans for managing the risks. Risk management professionals can play different functions for corporations, such as risk analyst, risk manager, risk management consultant, risk control supervisor, director of corporate risk management and chief risk officer, etc. The financial services sector will continue to be the strongest recruiter for risk management professionals due to increased regulation and public sector scrutiny around the world. There is a growing shift in demand to have professionals with data analytics skills and who can glean information about risks from models and provide insights and advice to organizations. The proposed new program offers an integrated education on both risk management and predictive analytics, which can prepare students for the changing needs of the risk management profession.

2) What resources will be provided to assist students with job placement?

The academic professional hired full time for this program is dedicated to provide career counseling and advising services to students in this program. We also intend to develop a summer internship program where students will be matched with potential employers. A pilot program was successfully implemented with existing undergraduate students in summer 2019. Many students received full-time job opportunities they interned with. We expect to use the connections developed for this pilot program and expand it to master's students from the PARM degree program.

PROGRAM REGULATION & ASSESSMENT

1) **Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning.** *Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable*

This program prepares students for the nascent profession of predictive analytics; it provides background and skill sets for data analytics with focus on financial and insurance industries. A student successfully finishing the program will typically have acquired a broad foundation of machine learning and predictive modeling techniques to forecast outcomes and glean valuable insights that can lead to better-informed business and investment decisions.

The assessment of the above-stated learning objectives will include:
- the job placement/graduate school acceptance rates

- feedback from employers

- graduate satisfaction surveys

These assessments will be conducted on an annual basis. We conduct exit surveys on all students each year, which should provide data on graduate students' job placement and graduate school acceptance rates. On the survey we will design questions to assess student's overall evaluation of these learning objectives. The curriculum was developed in close collaboration with industry partners. We expect to maintain close relationship with them and seek their feedback on the quality of our graduates on a regular basis.

2) Is the career/profession for graduates of this program regulated by the State of Illinois? If yes, please describe.

No

ACADEMIC CATALOG ENTRY

All proposals must submit the major requirements (courses, hours) for the proposed curricula. Please see the University of Illinois Academic Catalog- http://catalog.illinois.edu/ for your unit for an example of the entry.

This proposed new degree program is designed to respond to a large and growing demand for professionals with expertise in modern statistical techniques combined with an understanding of risk management in a wide range of industries including insurance, consulting, investment, pension, healthcare, banking and financial services. This program combines training in modern statistical methods with actuarial science principles and financial risk management. The coursework is intended for students who have the prerequisite quantitative background to train for careers in predictive analytics for insurance and other financial settings by providing a multidisciplinary and integrated program. Core requirements include courses from three disciplines, a course in financial risk management, courses in risk management and predictive analytics from an actuarial science perspective, and training in statistical machine learning, big data techniques, and Bayesian statistical methods. Related courses from the three disciplines may then be chosen as electives for students to reach their individualized educational goals. Courses will be scheduled so that students may complete the 32-hour program in one academic year.

Each concentration requires 12 hours of common core courses, organized around three broad areas of expertise, including a case study course. Each concentration also requires 12 hours of related area coursework specific to the concentration, plus an additional 8 hours of electives from a prescribed list included in this proposal. At least 12 hours must be taken at the 500 level.

Core Requirements for both concentrations (12 hours):
1. FIN 530: Foundation in Risk Management (2 hours)
2. ASRM 410: Investment and Financial Markets
3. ASRM 552 Predictive Analytics (4 hours)
4. ASRM 539: Risk Management and Decision Making (2 hours)

FIN 530 introduces financial risk management applied to such topics as reinsurance, loss reserving, and catastrophic risk management. ASRM 410 provides a theoretical foundation for financial models and their applications to insurance and other financial risks. Insurance companies and financial service firms are capitalizing on the tremendous value that data analytics can bring to their decision-making. ASRM 552 focuses on financial and insurance applications of statistical techniques to build predictive models, with integrated case studies and training on computational software packages and effective communication of statistical results. Either of the two case study courses will give students the opportunity to practice their existing data analytics skills to solve diverse real-world cases. Students will also deepen their ability to select the appropriate method to solve each problem, clearly and concisely present results, and clearly articulate the strengths and limitations of their analyses.

Concentration Specific Requirements (12 hours):

A. **Concentration in Financial and Insurance Analytics**

   1. STAT 431 Applied Bayesian Analysis (4 hours)
   2. STAT 432 Basics of Statistical Learning (4 hours)
   3. STAT 480 Data Science Foundations (4 hours)

STAT 431 introduces the Bayesian approach to statistical modeling and focuses on methods for computation and data analysis in this paradigm. STAT 432 covers many of the most widely used methods of machine learning for prediction and classification and provides a methodological foundation for predictive analytics. STAT 480 considers methods of data management and analysis for "big data". It considers the most modern techniques necessary for the analysis of massive datasets.

B. Concentration in Enterprise Risk Management (12 hours)

1. FIN 526: Enterprise Risk Management (4 hours)
2. FIN 567: Financial Risk Management (4 hours)
3. ASRM 533: Risk Management Practices and Regulation (4 hours)

FIN 526 offers an overview of the applications of basic risk management principles to all risks facing an organization. FIN 567 focuses on statistical techniques used in financial risk management rather than risk management practice, cases, or valuation issues, whereas ASRM 533 offers a complement by covering current market practices of risk management, risk compliance and regulation.

Electives (8 hours):
Two of the following:
ASRM 409: Stochastic Processes for Finance and Insurance
ASRM 499: Topics in Actuarial Science
ASRM 510: Financial Mathematics
ASRM 533: Risk Management Practices Regulation*
ASRM 561: Loss Data Analytics and Credibility
ASRM 569: Extreme Value Theory and Catastrophe Modeling
ASRM 575: Life Insurance and Pension Mathematics
ASRM 595: Advanced Topics in Actuarial Science and Risk Analytics
FIN 431: Property and Casualty Insurance
FIN 511: Investment
FIN 512: Financial Derivatives
FIN 513: Financial Engineering I
FIN 514: Financial Engineering II
FIN 515: Fixed Income Portfolios
FIN 526: Enterprise Risk Management*
FIN 551: International Finance
FIN 567: Financial Risk Management*
FIN 568: Behavioral Finance
FIN 580: Special Topics in Finance (Big Data Analytics)
FIN 590: Individual Study and Research
MATH 563: Risk Modeling and Analysis
STAT 542: Statistical Learning
STAT 590: Individual Study and research

*If not taken as a core requirement within the concentration

Master of Science in Predictive Analytics and Risk Management, Financial and Insurance Analytics Concentration

Core Courses:	12 Hours
FIN 530- Foundation in Risk Management	2
ASRM 410 – Investment and Financial Markets	4
ASRM 539 - Risk Management and Decision Making	2
ASRM 552 - Predictive Analytics	4
Concentration Required Courses:	**12 Hours**
STAT 431- Applied Bayesian Analysis	4
STAT 432- Basics of Statistical Learning	4
STAT 480- Data Science Foundations	4
Electives:	**8 Hours**
ASRM 409: Stochastic Processes for Finance and Insurance ASRM 499: Topics in Actuarial Science ASRM 510: Financial Mathematics ASRM 533: Risk Management Practices Regulation ASRM 539: Risk Management and Decision* ASRM 561: Loss Data Analytics and Credibility ASRM 569: Extreme Value Theory and Catastrophe Modeling ASRM 575: Life Insurance and Pension Mathematics ASRM 595: Advanced Topics in Actuarial Science and Risk Analytics FIN 431: Property and Casualty Insurance FIN 511: Investment FIN 512: Financial Derivatives FIN 513: Financial Engineering I FIN 514: Financial Engineering II FIN 515: Fixed Income Portfolios FIN 526: Enterprise Risk Management FIN 551: International Finance FIN 567: Financial Risk Management FIN 568: Behavioral Finance FIN 580: Special Topics in Finance (Big Data Analytics) MATH 563: Risk Modeling and Analysis STAT 542: Statistical Learning STAT 590: Individual Study and research	
Total	32

Minimum 500-level Hours Required Overall:	12
Minimum GPA:	2.75

*If not taken as a core requirement within the concentration

Master of Science in Predictive Analytics and Risk Management, Enterprise Risk Management Concentration

Core Courses:	12 Hours
FIN 530- Foundation in Risk Management	2
ASRM 410 – Investment and Financial Markets	4
ASRM 539 -- Risk Management and Decision Making	2
ASRM 552 - Predictive Analytics	4
Concentration Required Courses:	**12 Hours**
FIN 526- Enterprise Risk Management	4
FIN 567- Financial Risk Management	4
ASRM 533- Risk Management Practices and Regulation	4
Electives:	**8 Hours**
ASRM 409: Stochastic Processes for Finance and Insurance ASRM 499: Topics in Actuarial Science ASRM 510: Financial Mathematics ASRM 539: Risk Management and Decision* ASRM 561: Loss Data Analytics and Credibility ASRM 569: Extreme Value Theory and Catastrophe Modeling ASRM 575: Life Insurance and Pension Mathematics ASRM 595: Advanced Topics in Actuarial Science and Risk Analytics FIN 431 Property and Casualty Insurance FIN 511 Investment FIN 512: Financial Derivatives FIN 513 Financial Engineering I FIN 514 Financial Engineering II FIN 515 Fixed Income Portfolios FIN 551: International Finance FIN 568: Behavioral Finance FIN 580: Special Topics in Finance (Big Data Analytics) FIN 590: Individual Study and Research MATH 563: Risk Modeling and Analysis STAT 542: Statistical Learning STAT 590: Individual Study and research	

Total	32
Minimum 500-level Hours Required Overall:	12
Minimum GPA:	2.75

*If not taken as a core requirement within the concentration

ACADEMIC CATALOG ENTRY

Master of Science in Predictive Analytics and Risk Management with Concentrations: Financial and Insurance Analytics and Enterprise Risk Management

This proposed new degree program is designed to respond to a large and growing demand for professionals with expertise in modern statistical techniques combined with an understanding of risk management in a wide range of industries including insurance, consulting, investment, pension, healthcare, banking and financial services. This program combines training in modern statistical methods with actuarial science principles and financial risk management. The coursework is intended for students who have the prerequisite quantitative background to train for careers in predictive analytics for insurance and other financial settings by providing a multidisciplinary and integrated program. Core requirements include courses from three disciplines, a course in financial risk management, courses in risk management and predictive analytics from an actuarial science perspective, and training in statistical machine learning, big data techniques, and Bayesian statistical methods. Related courses from the three disciplines may then be chosen as electives for students to reach their individualized educational goals. Courses will be scheduled so that students may complete the 32-hour program in one academic year.

Each concentration requires 12 hours of common core courses, organized around three broad areas of expertise, including a case study course. Each concentration also requires 12 hours of related area coursework specific to the concentration, plus an additional 8 hours of electives from a prescribed list included in this proposal. At least 12 hours must be taken at the 500 level.

Core Requirements (12 hours):
FIN 530: Foundation in Risk Management (2 hours)
ASRM 410: Investment and Financial Markets
ASRM 539: Risk Management and Decision Making (2 hours)
or FIN 539: Cases in Risk Management (2 hours)
ASRM 552 Predictive Analytics (4 hours)

FIN 530 introduces financial risk management applied to such topics as reinsurance, loss reserving, and catastrophic risk management. ASRM 410 provides a theoretical foundation for financial models and their applications to insurance and other financial risks. Insurance companies and financial service firms are capitalizing on the tremendous value that data analytics can bring to their decision-making. ASRM 552 focuses on financial and insurance applications of statistical techniques to build predictive models, with integrated case studies and training on computational software packages and effective communication of statistical results. Either of the two case study courses will give students the opportunity to practice their existing data analytics skills to solve diverse real-world cases. Students will also deepen their ability to select the appropriate method to solve each problem, clearly and concisely present results, and clearly articulate the strengths and limitations of their analyses.

Financial Operations for the Master of Science
in Predictive Analytics & Risk Management (PARM)

1. Initial Revenue Distribution
   a. Tuition will be passed from the Provost office to the Liberal Arts and Science (LAS) College as part of the IVCB budget model. LAS should receive 100% of the tuition earned from this program. The LAS budget office will identify the revenue received by PARM from the program code used.   A governance committee is currently working on revenue distributions across programs for LAS but it an anticipated there will be an approximately 70/30 split (70% or the revenue to the program and 30% to LAS).
   b. Differential fee revenue is expected to support the Predictive Analytics Education and Research Innovation Fund. The fund will be under the management of the PARM Director and made available to support innovations and collaborations among faculty members and students in all three departments. A report of funding activities will be provided to heads of Mathematics, Statistics and Finance or their designees at the end of each academic year.

2. Fixed Costs. A program code will be established in Math to record all fixed costs. This program code will be under the management of the PARM Director. Fixed costs will have items that include, but not limited to:
   a. Stipend for Program Director
   b. Administrative Professional Position
   c. Civil Service Employee
   d. Instructional Costs
   e. Recruitment Expenses
   f. Guest Speakers
   g. Course Development

3. Final Distribution of Revenue. Revenues will be distributed to the Math department from LAS to the same program code where fixes costs are recorded. Net income will be distributed on an Academic Year basis. A report of the Net Income calculation will be provided to representatives of both Statistics and Finance at the time of revenue distribution. The Net Revenue will be distributed among the three areas based on instructional hours that will be confirmed by the head or their designee for each area.