

Program Proposal for an Undergraduate Certificate

1. Name of the proposed undergraduate certificate.

Actuarial Science

2. Name of the department(s) involved.

Finance (College of Business), Mathematics (College of Liberal Arts and Sciences),
Statistics (College of Liberal Arts and Sciences)

3. Name of contact person(s).

Dr. Danny J. Johnson, Associate Dean, College of Business
Dr. Arne Hallam, Associate Dean, College of Liberal Arts and Sciences
Dr. Amy Froelich, Associate Professor of Statistics
Dr. Cliff Bergman, Professor of Mathematics

4. General description of the undergraduate certificate.

Actuarial science is a specialized discipline incorporating mathematics and statistics, as well as fundamental principles of business, especially finance. The industry has a very regimented accreditation process consisting of a number of exams and classes (called Validation by Educational Experience, or VEE, in the field). The goal of the certificate program is to prepare students to succeed on the first 2-4 exams. The certificate itself will be a signal to prospective employers that the holder is well-equipped to continue the process and contribute to the company.

The specific course requirements are largely dictated by the actuarial exams and VEE's mentioned above. The first two exams are those in Probability and in Financial Mathematics. Preparation for those exams is provided by STAT 326 and STAT 341 in the first case, and by MATH 240 and FIN 320 in the second. The VEE in Economics is covered by ECON 101-102. Similarly, Math 441-442 prepares students for the Life Contingencies exam, FIN 342 and STAT 342 for the Models of Financial Economics exam, and FIN 310 for the VEE in Corporate Finance.

The courses required for the certificate are shown in Table 1 on the next page. (The courses are listed in alphabetical order, not in the order in which they will be taken.) As indicated, the certificate requires seven courses for a total of 23 credits. At least 9 credits used for the certificate cannot be used to meet any other department, college or university requirement for the baccalaureate degree except to satisfy the total credit requirement for graduation and to meet credit requirements in courses numbered 300 or above. Courses for the certificate cannot be taken on a pass/not-pass basis.

Each of the required courses has one or more prerequisite courses totaling 30 or 31 credits as noted in Table 1 on the next page. Students majoring in Mathematics or Statistics take approximately half of these prerequisite courses as part of their respective major. For students with other majors, the number of prerequisite credits completed outside the major will depend on the specific requirements of the major. All required and prerequisite courses are currently in existence and taught on a regular basis, except for the two new required courses MATH 441 – Life Contingencies I and MATH 442 – Life Contingencies II. These courses will need to be added to the curriculum not only for the certificate program, but for the new actuarial science major as well (see below for more information).

Table 1. Required Courses and Corresponding Prerequisite Courses for Certificate in Actuarial Science

Required Courses	Prerequisite Course(s)*
FIN 320 – Investments (3 credits)	FIN 301 (3 credits) ACCT 284 (3 credits) STAT 226 (3 credits) ECON 101 (3 credits)
FIN 424 – Financial Futures and Options (3 credits)	FIN 320 STAT 326 (3 credits) STAT 226
MATH 240 – Interest Theory (3 credits)	MATH 166 (4 credits) MATH 165 (4 credits)
MATH 441 – Life Contingencies I (3 credits)	STAT 341
MATH 442 – Life Contingencies II (3 credits)	MATH 441– Life Contingencies I
STAT 341 – Introduction to the Theory of Probability and Statistics I (4 credits**)	MATH 265 (4 credits) MATH 166 MATH 165
STAT 342 - Introduction to the Theory of Probability and Statistics II (4 credits**)	STAT 341 MATH 207 (3 credits) or MATH 317 (4 credits)
Total Required Courses = 23 credits	Total Prerequisite Courses = 30 or 31 credits
*Note: Listed courses with no credit amount shown have already been considered in the total credit count. **As of Fall 2018	

5. **Need for the proposed undergraduate certificate.**

As a discipline, actuarial science applies mathematical and statistical methods to assess risk in insurance, finance and other industries and professions. Outside of high-school teaching, it offers one of the few clear-cut career paths for undergraduate

majors in mathematics and it is one of the primary career options for statistics majors with an interest in business applications. We regularly get requests from both mathematics and statistics majors for a program in this field. For many prospective actuaries, mathematics proves to be a major hurdle to success in the field. However, STEM majors with the necessary background in mathematics and statistics are well positioned for success, some in the more technical aspects, in this field. A certificate program would allow our students to demonstrate to employers they have obtained the specialized knowledge required for the field.

Many Iowa State students transfer, or consider transferring, from engineering to other STEM fields, particularly mathematics and/or statistics. Very often, they hesitate because of a perceived absence of professional training and certification in our fields of study. This certificate helps address those concerns and enables students to choose the major that best matches their interests and abilities while obtaining the skills necessary to be successful in the field.

6. Objectives of the proposed undergraduate certificate including the student learning outcomes and how the learning outcomes will be assessed.

In addition to a well-rounded background in mathematics and statistics, students graduating with the certificate will have mastery of the mathematical, statistical, and financial bases of actuarial science. They will have the skills required to pass the first 3 to 4 professional exams offered by the professional actuarial organizations, which are an essential component for a career in this field.

Learning Outcomes

- 1) Students will master the quantitative and analytical skills required to obtain an entry-level position in the profession.
- 2) Students will have sufficient background to pass the first 3 to 4 professional exams offered by the professional actuarial organizations.
- 3) Students will apply actuarial mathematics to problems in finance, investment, and risk analysis.
- 4) Students will demonstrate the ability to communicate the results of quantitative analysis, both in writing and orally.

Evaluation of Learning Outcomes

- 1) Each of the following courses will utilize either exam questions or projects to determine mastery of quantitative and analytical skills: FIN 424, MATH 442, STAT 341, STAT 342.
- 2) Success rate on exams offered by the professional actuarial organizations.
- 3) List of student internship experiences and first position after graduation.
- 4) Results of projects in advanced ISUComm class as well as feedback from internship mentors.

7. Relationship of the undergraduate certificate to other programs at Iowa State University.

The Certificate program is closely related to the anticipated major in Actuarial Science being proposed by the College of Business. While the major is more “business oriented,” and contains many non-technical requirements, the certificate is more focused on developing the mathematical and statistical skills of our students. However, the two programs will produce a good deal of synergy. For example, students from both programs will be required to complete the two new courses in the study of Life Contingencies offered by the Department of Mathematics (Life Contingencies I and II). Students from both programs will also be able to participate in the activities of the Iowa State chapter of Gamma Iota Sigma, the International Risk Management, Insurance and Actuarial Science Collegiate Fraternity.

8. Relationship of the undergraduate certificate to the strategic plans of the university, of the college, and of department or program.

Currently, the Mathematics Department offers an option to the major called “Math+Actuarial Science.” Unfortunately, the diploma and transcript only shows “Mathematics” as the major. The certificate will be a more formal recognition of the program followed by these students. It is also a certification familiar to employers in this field. If the certificate program is approved, the Math+Actuarial Science option to the Mathematics major will be discontinued.

The Certificate will be an additional STEM career path for students both in and outside the College of Liberal Arts and Sciences. This is a central component of the College’s long-term strategy.

9. Comparison of the proposed undergraduate certificate with similar programs at other universities, including the Regent’s universities.

The University of Iowa offers an actuarial science major located in the Department of Statistics and Actuarial Science, the University of Northern Iowa has a major located in the Department of Mathematics, and Drake University in Des Moines has an actuarial science major located in the College of Business. None of these universities has a certificate program in actuarial sciences.

10. Program requirements and procedures, including:

a. *prerequisites for prospective students;*

The certificate is intended for students enrolled in a baccalaureate degree program at Iowa State University or that currently hold a baccalaureate degree from an accredited institution. Students holding a baccalaureate degree from an accredited institution must meet admission requirements to be enrolled at Iowa State University. To enroll in the certificate program, students need to complete the

following prerequisite courses: ACCT 284, ECON 101, MATH 165 and 166, and STAT 226 (or equivalent) with a minimum (overall) GPA of 2.5.

b. *application and selection process;*

The student will fill out the standard “Request for Undergraduate Certificate,” obtain an advisor’s signature and submit to the Actuarial Sciences Certificate Committee for approval.

c. *language requirements;*

There are no additional language requirements other than those required for admission to Iowa State University.

d. *courses and seminars presently available for credit toward the program;*

FIN 320 – Investments

FIN 424 – Financial Futures and Options

MATH 240 – Interest Theory

STAT 341 – Introduction to the Theory of Probability and Statistics I

STAT 342 - Introduction to the Theory of Probability and Statistics II

e. *proposed new courses or modifications of existing courses;*

Two new courses will be required for the certificate, MATH 441 – Life Contingencies I and MATH 442 – Life Contingencies II. Both of these courses are also required for the proposed major in actuarial science. At this time, MATH 441 has been approved as an experimental course in LAS (see LASCC minutes of Sept. 1, 2017). MATH 442 has not yet been proposed or approved.

f. *advising of certificate students;*

Academic advisors in the College of Business and the Departments of Mathematics and Statistics in the College of Liberal Arts and Sciences will act as advisors for students enrolled in the actuarial sciences certificate.

g. *implications for related areas within the university.*

The certificate requires several courses in Finance, Accounting, and Economics. This will result in a modest increase in demand for those classes.

11. General description of the resources currently available and future resource needs, in terms of:

a. *faculty members;*

Most of the courses required for the Actuarial Sciences Certificate already exist at Iowa State University and are being taught by highly qualified faculty in the College of Business and the Departments of Mathematics and Statistics. Two new courses will be required for the certificate, MATH 441 – Life Contingencies I and MATH 442 – Life Contingencies II. As explained in Section 10e, MATH 441x has been approved by LAS. 442x has not yet been proposed. Depending on the expertise of the existing Mathematics faculty, it may be necessary to hire a working actuary to teach these courses. LAS did approve such a hire for Spring 2018, however it has now been determined that MATH 441-442 will not be offered until AY2020. As demand for both the actuarial science major and actuarial sciences certificate programs increase, additional sections of the required courses may have to be opened to accommodate growth. The tuition revenue received from both the actuarial science major and the actuarial sciences certificate should be adequate to hire the needed faculty.

b. *computers, laboratories, and other facilities;*

Other than faculty and classroom space, the main resources needed to teach the program are computer hardware and software. These resources are already available in different computer labs and classrooms around the university.

c. *library facilities (journals, documents, etc.) in the proposed area;*

It is not anticipated that any additional library resources will be needed by students enrolled in the certificate program.

d. *supplies, field work, student recruitment, etc.*

Once the certificate is approved, marketing materials about the program will be developed and will be shared with prospective students through our normal marketing channels in the Office of Admissions, the College of Business and in the College of Liberal Arts and Sciences. In addition, the Department of Mathematics and Statistics will prepare special materials to show how a certificate in actuarial sciences can be added to the respective majors. Details of the certificate will also be available on Iowa State University's website.

12. Describe the needs for new resources and/or reallocated resources. Attach to the program proposal memos from the department chair(s), the college dean(s), and other appropriate persons, agreeing to the allocation of new resources and/or the reallocation of resources.

As mentioned in 11a, most of the courses required for the Actuarial Sciences Certificate already exist at Iowa State University and are being taught by highly qualified faculty in the College of Business and the Departments of Mathematics and Statistics. Two new courses will be required for the certificate, MATH 441 – Life Contingencies I and MATH 442 – Life Contingencies II. As explained in Sections 10e and 11a, MATH 441x has been approved by LAS. MATH 442x has not yet been proposed. LAS has

approved the hire of a working actuary to teach the courses if necessary. As demand for both the actuarial science major and actuarial sciences certificate programs increase, additional sections of the required courses may have to be opened to accommodate growth. The tuition revenue received from both the actuarial science major and the actuarial sciences certificate should be adequate to hire the needed faculty.

- 13. Attach to the program proposal, letters of support, recommendations, and statements when appropriate, from programs and departments at ISU which are associated with the proposed program or have an interest in the proposed program.**

See Appendix A for letters of support from the Department of Finance in the College of Business and the Departments of Mathematics and Statistics in the College of Liberal Arts and Sciences.

- 14. If the new program is interdisciplinary, a governance document should be created and submitted to the Associate Provost for Academic Programs. Indicate here that it has been completed.**

See attached.

Appendix A – Letters of Support

November 7, 2017

Dear LAS Curriculum Committee:

The colleges of Liberal Arts and Sciences and Business fully support both the proposed major and certificate in Actuarial Science. They will reach a wide range of students.

The major is intended for students entering the College of Business. In addition to providing a substantial grounding in the mathematical and statistical foundations of the subject, it includes a full suite of courses important to the business community, including accounting, management, marketing, and finance.

The certificate is designed for students in LAS, and possibly other colleges who have a strong mathematical background and are looking for a well-defined career path that will utilize those skills. Certificates are familiar to personnel offices in industry. This certificate will assure our industry partners that the holder has a solid background in those areas of mathematics and finance that are needed to assess risk in insurance, finance, and other industries and professions.

The two colleges are collaborating on this project, LAS by developing specialized courses that are critical to the programs (Math 240X, 441X, 442X), and Business by making available the Finance courses that are normally not open to students outside of the college. In addition, students from both programs will benefit from the relationships that Iowa State will be developing with the insurance industry.

Sincerely,



David P. Spalding
Raisbeck Endowed Dean
Debbie and Jerry Ivy College of Business



Beate Schmittmann
Dean
College of Liberal Arts & Sciences

Cliff,

The Finance Department has reviewed the proposed certificate program for Actuarial Sciences and support this program. We believe that it is a strong interdisciplinary program that will benefit students looking toward a career in actuarial science.

Thank you for your efforts in moving this program forward.

Rick

Rick Dark

Chair, Departments of Accounting & Finance

515-294-8112

IOWA STATE UNIVERSITY
COLLEGE OF BUSINESS

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Department of Mathematics
396 Carver Hall
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515-294-1752
FAX 515-294-5454
Email: mathematics@iastate.edu

To: Clifford Bergman, Mathematics
From: Henry Schenck, Chair, Mathematics
Re: Actuarial Studies Certificate
Date: September 28, 2017

The Department of Mathematics is pleased to support the proposed Certificate in Actuarial Studies. We believe this option will be very attractive to undergraduate majors in the College of Liberal Arts and Sciences, indeed throughout the University. We look forward to working with both the Department of Statistics and the College of Business on this new program.



Dr. Henry K. Schenck
Professor and Chair
Department of Mathematics
Iowa State University

Cliff –

We've reviewed the proposed certificate program for Actuarial Sciences, and are in support of it. We are especially happy to see that students majoring in Statistics, who are interested in a career in actuarial science, will be able to gain access to important courses in Finance and Business.

Thanks for all your work in preparing this.

– Max

Max D. Morris

Professor and Chair

Department of Statistics

Iowa State University

Ames, IA 50011

515 294 2775

Interoffice Communication

DATE: November 8, 2017
TO: Clifford Bergman, Department of Mathematics
FROM: Max D. Morris, Professor and Chair of Statistics
SUBJECT: Actuarial Science Certificate Program



The Department of Statistics has reviewed the proposed certificate program in Actuarial Sciences, and are in support of it. We are especially happy to see that students majoring in Statistics, who are interested in a career in actuarial science, will be able to gain access to important courses in Finance and Business.

The faculty of the department voted on the issue of approval for this certificate program at a regular faculty meeting on November 8, 2017. The result of that vote was 21 in favor of supporting the proposal, 0 opposed, and 1 abstention.

Thanks again for all your work in preparing this.

Actuarial Science Certificate Governance Document

Mission Statement

Actuarial Science is the discipline concerned with evaluating risk in finance, insurance, and business. Practitioners must possess a deep background in mathematics, statistics, and the basic principles of business. The Certificate in Actuarial Science will provide evidence that the holder is well-versed in these principles and is prepared to “hit the ground running” when employed as an actuary.

Actuarial Science Certificate Committee

Primary responsibility for decisions regarding the certificate will be managed by the Actuarial Science Certificate Committee. This includes requests for waiver of requirements. This committee will serve as the Curriculum Committee for the program.

Membership of the Committee

The Committee shall consist of 4 members, one each appointed by the Department chairs of Mathematics and Statistics, and by the Deans of the Colleges of Liberal Arts and Sciences and Business.

Program Advisor

The Departments of Mathematics and Statistics will jointly designate an individual, either Faculty or P&S, to serve as academic advisor to the program. The advisor will be responsible for answering questions about the program, approving certificate requests, forwarding requests for waivers, etc. to the committee, keeping track of enrollment in the program, and checking completion of requirements for graduating seniors.

Admission to the Program

To be admitted to the Certificate Program, a student must be enrolled in a baccalaureate degree program at Iowa State University or currently hold a baccalaureate degree from an accredited institution. Students holding a baccalaureate degree from an accredited institution must meet admission requirements to be enrolled at Iowa State University. Before being admitted to the program students must complete the following prerequisite courses: ACCT 284, ECON 101, MATH 165 and 166, and STAT 226 with a minimum overall GPA of 2.5.

All requests for admission to the program will be initiated by the student by filing the standard “Request for Undergraduate Certificate.” The student will obtain the signature of his/her academic advisor who will forward the petition to the Program Advisor for approval.

Requests for waivers or substitutions to the requirements

In order to request a waiver of a requirement or a course substitution, a student shall write a memo justifying the request, have it approved by his/her academic advisor, and forwarded to the Committee. The Committee shall approve or deny the request as it deems appropriate.

Changes to the Program

Changes to the Certificate Program will normally be initiated by the Committee. Changes approved by the Committee must then be approved by the curriculum committees of both the College of Liberal Arts and Sciences and the College of Business.

Changes to this Governance Document

Proposals to change this Governance Document can be initiated by either of the department chairs in Mathematics or Statistics, or the curriculum committees in either the College of Liberal Arts and Sciences or the College of Business. A consensus of all 4 of these parties will be required for the change to take effect.

Academic Program Approval Voting Record

This document is to be appended as the last page of the proposal for any new or revised academic program to record the successive votes of approval as the proposal moves through its required review and approval steps. Consult Faculty Handbook Section 10.8 or the Faculty Senate Curriculum Committee website for information regarding Committee review and voting requirements for each action.

Curricular Action: (check appropriate boxes below)

1. New Program Name Change Discontinuation Concurrent Degree for:
2. Undergraduate Major Graduate Major Undergraduate Minor Graduate Minor
 Undergraduate Certificate Graduate Certificate Other: _____
3. Name of Proposed Change: Certificate in Actuarial Science _____
4. Name of Contact Person: Cliff Bergman e-mail address: _cbergman@iastate.edu
5. Primary College: LAS Secondary College: _____
6. Involved Department(s): MATH STAT
FINANCE _____

Voting record for this curricular action:

Voting Body	Votes			Date of Vote
	For	Against	Abstain	
Dept. or Program Committee				
MATH	36	0		20 October 2017
Finance	13	2		25 ctober 2017
Stat	21	0	1	8 November 2017
College Curriculum Committee				
--LAS Curriculum Committee	8	0	0	10 November 2017
College Approval Vote				
--LAS Representative Assembly	22	0	0	28 November 2017
Graduate Council	N/A			
Faculty Senate Curriculum Committee	7	0	0	1 December 2017
Faculty Senate Academic Standards- review of grade minimum				Jan 15 2018 email from Frank Peters, approved.
Faculty Senate Academic Affairs Council	9	0		2/6/2018
Faculty Senate				

[FSCC – November 2013]