Proposal for a Minor in Actuarial Science

Part 1: Broad Description and Purpose of Program

What is Actuarial Science?

Actuaries are business professionals who analyze the financial consequences of risk (From: Society of Actuaries). They use mathematics, statistics and financial theory to study uncertain future events, most often with respect to insurance and pension programs. As a career, actuarial work is highly rewarding. The U.S. News and World Report ranks "Actuary" as #9 in their list of "Best Business Jobs" ("Statistician" is #1 and "Mathematician" is #5). They report that the median salary is $96,700 with a very low unemployment rate 4.0%. It is also predicted that this profession will grow at a rate of 18% in the next 8 years. (From: U.S. News).

In order to become an actuary, one must pass a series of examinations that assess a core set of knowledge beginning with Probability and Statistics (SOA Exam P) and Financial Mathematics (SOA Exam FM), progressing into more insurance-specific topics such as Life Contigencies (SOA Exam MLC) and then -- further in one's career -- into much more specific areas such as Enterprise Risk Management (SOA Exam ERM). These exams are famously intense and difficult. Most examinees spend several months preparing each exam.

In addition to the exams, actuaries have so-called Validation by Educational Experience (VEE) requirements. These are completed by receiving a specified grade in certain VEE-approved courses. The subjects of these courses consist of Economics, Corporate Finance and Applied Statistical Methods (From: SOA VEE Home Page).

A typical entry-level actuary has just graduated from college with a Mathematics or Statistics major, often with a related Minor such as Economics or Actuarial Science. This person has also typically taken and passed one or two of the initial examinations, e.g., Exam P or Exam FM, and has participated in at least one internship with an insurance or risk management firm.

What is the purpose of a Minor in Actuarial Science?

Offering a minor program in Actuarial Science gives the college graduate a often-needed initial boost into their actuarial career. In such a program, a college will give potential actuaries the opportunity to learn the fundamental aspects of business and risk management in business while teaching them the foundational mathematics and statistics required by the examinations and their career ahead. In addition, the minor will give students an opportunity to fulfill several of their upcoming VEE requirements.

N.B. -- Preparation for the actuarial exams, at least for Exams P and FM, has been an informal service that the MT/CS Department has provided for many decades at this point. This minor program is meant to formalize this service and to help JCU recruit and retain students as a result of this formalization.

How does this program relate to existing programs?

Due to the highly specialized nature of Actuarial Science as a career as well as the high level of mathematics needed to succeed in it, this minor program is best paired with a major in Mathematics. The actuarial job market is quite competitive. So, it is in the best interests of our students to front-load this minor program with courses such as the Calculus I-II-III sequence that their competitor from other universities will also be prepared in.

Nevertheless, this minor also works very well with a major in Physics, Economics or Finance. In the narrative below, exemplar 4-year plans with this minor will be given with these majors in mind. Furthermore, since this minor is completely self-contained, any student with any major may enroll and succeed with this minor as long as she has the moxie, the dedication and the willingness to take on a heavy course load in addition to that of her major course of study.

Part 2: Program Curriculum

Program Learning Goals

There are three main learning goals for this minor program.

Goal 1: Quantitative and Analytical Skills

Students will master the quantitative and analytical skills required to obtain an entry level position in the actuarial profession. In particular, students will be proficient in calculus techniques for modeling and analysis purposes and in probability and statistics.

Goal 2: Professionally Credentialed Knowledge

Students will acquire the knowledge to qualify for professional credentials awarded by the Society of Actuaries and the Casualty Actuary Society. In particular, students will study the content material of Exam P (which focuses on probability) and Exam FM (which focuses on financial mathematics). Additionally, students will acquire Validation through Educational Experience (VEE) for Advanced Statistical Methods and Economics.

Goal 3: Proficiency in Research and Technology

Students will attain proficiency in research methodology and computer technology. In particular, students will learn to use R and other software packages to solve statistical problems.

Required Courses of Program

Course	Course Title	Credits	Learning Goal
MT 135	Calculus I	4	Goal 1: Foundational Quantitative Content
MT 136	Calculus II	4	Goal 1: Foundational Quantitative Content
MT 233	Calculus III	4	Goal 1: Foundational Quantitative Content
MT 229	Probability and Statistics	3	Goal 1: Foundational Quantitative Content Goal 3: Use of R and other software packages
MT 421	Mathematical Statistics	3	Goal 2: Exam P
MT 424	Applied Regression Analysis	3	Goal 2: VEE for Applied Statistical Methods Goal 3: Use of R and other software packages
MT 225	Actuarial Mathematics	3	Goal 2: Exam FM
EC 201	Principles of Economics I	3	Goal 2: VEE for Economics: Microeconomics
EC 202	Principles of Economics II	3	Goal 2: VEE for Economics: Macroeconomics
Total credits:		30	

The following substitutions may be made in order to complete this minor:
- Instead of MT 229, a student may substitute the EC 207-208 course sequence.
- Instead of MT 424, a student may substitute EC 410 (Econometrics). However, note that EC 410 carries only part of the VEE for Applied Statistical Methods, namely, Regression, whereas MT 424 carries the entire VEE for Applied Statistical Methods (Regression and Time Series).

Furthermore, the following courses may be used to substitute any of the required courses above, except MT 135, MT 136, MT 225, MT 229, MT 233 and MT 421.

Course	Course Title	Credits	Learning Goal
DS 100	Introduction to Data Science	3	Goal 3: Data Science Research
CS 150	Database Systems	3	Goal 3: Use of Databases
FN 312	Business Finance	3	Goal 2: VEE Corporate Finance

Sample Four-Year Plans

The following charts show a number of sample four-year plans for this minor.

With Mathematics B.S. Major

With a Mathematics major, a student may take this minor as given below. Courses that are already required for the Mathematics major are given in blue.

Year	Fall Semester	Spring Semester
1	MT 135	MT 136 MT 229
2	MT 233 EC 201	MT 225 EC 202
3		MT 421
4	MT 424	

With Physics B.S. Major

With a Physics major, a student may take this minor as given below. Courses that are already required for any of the Physics majors are given in blue.

Year	Fall Semester	Spring Semester
1	MT 135	MT 136 MT 229
2	MT 233 EC 201	MT 225 EC 202
3		MT 421
4	MT 424	

With Economics Major

With an Economics major, a student may take this minor as given below. Courses that would count towards the Economics major are given in blue.

Year	Fall Semester	Spring Semester
1	MT 135 EC 201	MT 136 EC 202 EC 207
2	EC 208 MT 233	MT 225
3		MT 421
4	EC 410	

With Finance Major

With a Finance major, a student may take this minor as given below. Courses that would count towards the Finance major are given in blue.

Year	Fall Semester	Spring Semester
1	EC 201 MT 135	EC 202 EC 207 MT 136
2	EC 208 MT 233	FN 312 MT 225
3		MT 421
4	MT 424	

With Generic Major

With any major, a student may take this minor as given below.

Year	Fall Semester	Spring Semester
1	EC 201	EC 202
2	MT 135	MT 136 MT 229
3	MT 233	MT 225
4	MT 424	MT 421

Completion of SOA Exams

It is anticipated that each student in the program will have taken both Exam P and Exam FM by the end of the summer following graduation. In general, each student that has taken and passed

MT 421 will be prepared to take Exam P; and each student that has taken and passed MT 225 will be prepared to take Exam FM.

Part 3: Organization and Administration of Program

The Actuarial Science Minor Program will be housed within the Department of Mathematics and Computer Science. The Chair of the Department will designate a faculty member as the coordinator of this program. The coordinator has the following responsibilities:
1. Collect all assessment material from each relevant course,
2. Analyze the assessment data using the Program Learning Goals as benchmarks and make any needed programmatic or academics recommendations accordingly to the Department,
3. Meet with potential and current students in the program and answer questions and concerns regarding the program,
4. Help facilitate study sessions for students preparing to take Exam P or Exam FM,
5. Complete any other tasks needed to facilitate the running of this program on an ad hoc basis.

Part 4: Implementation Timetable and Other Issues

All of the courses of this minor program are currently being offered. The only course that is specific to actuarial science (MT 225) may be taught by Brendan Foreman at the MT/CS Department or an adjunct faculty member with expertise in this field. There are several individuals in the region with connections to JCU, who are qualified to teach this course. For this reason, this program may be implemented immediately and is not overly dependent on one individual member of the faculty.

Furthermore, the coordinator of this program (and the entire MT/CS faculty in as much as is possible) will actively recruit potential incoming students for this program. This can be done with visitations to local high schools as well as special events for high school students hosted by JCU designed to highlight the importance of mathematics in actuarial work and finance. It is hoped that this recruitment effort will help bring in five or more additional students per academic year.

Part 5: Assessment

The effectiveness of this program will be determined via four methods.

1. **Level of Completion of the Program Learning Goals**
   The coordinator will collect the final grades or other assessment scores of each student in the program for the required courses of the minor. These will be aggregated by Goal. They will also be analysed in terms of flow in order to determine an optimal sequence of courses.

2. **Performance on SOA Exams**
   The SOA publishes the information of all people who have taken and passed each exam. The coordinator will collect this information regarding the dates and grades of each SOA exam taken by each student in the program. This data will be analyzed in terms of pass rate and participation rate.

3. **Exit Interviews**
   The coordinator will interview graduating students in the program to determine their impressions of the courses and how the program may be improved.

4. **External Consultation**
   The coordinator will meet at the end of each Spring semester with local contacts in the insurance field and have them evaluate the overall aspect of the program.

The data from each of these sources will be analyzed and written as an annual report to the Department. This data and analysis will be used by the coordinator to develop any recommendations for improving the program.

Part 6: Anticipated Budget

All of the courses for this minor program are already being offered on a consistent basis. Furthermore, it is unlikely that implementation of this program will necessitate more frequent offerings of these courses, at least initially. Thus, this program will not need any additional funds to implement.

Given below is the budget matrix for anticipated revenue from this program for the next four years. This budget assumes that we will be able to successfully recruit five additional students each year for this program.

Proposed Minor in Actuarial Sciences

	Budget Summary	Yr 1		Yr 2		Yr 3		Yr 4	
		1718	Changes	1819	Changes	1920	Changes	2021	
1	**Net Tuition Revenue**	$ 28,105	21,339	$ 49,444	6,382	$ 55,826	6,670	$ 62,496	
2	**Costs**	-	-	-	-	-	-	-	
	Contribution Margin	28,105	21,339	49,444	6,382	55,826	6,670	62,496	
3	**Support for elsewhere**	-		-		-		-	
	Net Contributing Margin	$ 28,105	$ 21,339	$ 49,444	$ 6,382	$ 55,826	$ 6,670	$ 62,496	
1	**Net Tuition Revenue - Details**								
	Cohort year 1	5	-	5	-	5	-	5	
	Attrition	-	-	(2)	-	(2)	-	(2)	
	Total across campus	5	-	3	-	3	-	3	
	Cohort year 2	-	-	5	-	5	-	5	
	Attrition	-	-	-	-	(2)	-	(2)	
		-	-	5	-	3	-	3	
	Cohort year 3	-	-	-	-	5	-	5	
	Attrition	-	-	-	-	-	-	(2)	
		-	-	-	-	5	-	3	
	Cohort year 4	-	-	-	-	-	-	5	
	Attrition	-	-	-	-	-	-	-	
		-	-	-	-	-	-	5	
	Total number of students	5		8		11		14	
	Courses to be taken:								
	MT 135	4		4		4		4	
	MT 136	4		4		4		4	
	MT 229	3		3		3		3	
	MT 233			4		4		4	
	EC 201			3		3		3	
	MT 225			3		3		3	
	EC 202			3		3		3	
	MT 421					3		3	
	MT 424			-		-		3	
	Cr Hr for each student								
	Cohort 1	11		13		3		3	
	Cohort 2			11		13		3	
	Cohort 3					11		13	
	Cohort 4							11	
	Credit Hours Taught	55		94		103		112	
	Net tuition rate	1,277		1,315		1,354		1,395	
	Discount Rate	(766)		(789)		(812)		(837)	
	Net tuition per Cr Hr	511		526		542		558	
	Net tuition revenue	$ 28,105		$ 49,444		$ 55,826		$ 62,496	

Proposed Minor in Actuarial Sciences

	Budget Summary	Yr 1		Yr 2		Yr 3		Yr 4
		1718	Changes	1819	Changes	1920	Changes	2021
1	Net Tuition Revenue	$ 28,105	21,339	$ 49,444	6,382	$ 55,826	6,670	$ 62,496
2	Costs	-	-	-	-	-	-	-
	Contribution Margin	28,105	21,339	49,444	6,382	55,826	6,670	62,496
3	Support for elsewhere	-		-		-		-
	Net Contributing Margin	$ 28,105	$ 21,339	$ 49,444	$ 6,382	$ 55,826	$ 6,670	$ 62,496
2	Costs Details -							
	Payroll Fringe Rate -							
	Faculty fringe rate	0.375		0.375		0.375		0.375
	Staff PT fringe rate	0.08		0.08		0.08		0.08
	Dir Payroll - fac. course release	-	-	-	-	-	-	-
	Fringes	-	-	-	-	-	-	-
	Faculty Payroll	-	-	-	-	-	-	-
	Fringes	-	-	-	-	-	-	-
	Faculty PR - course development	-	-	-		-	-	-
	Fringes	-	-	-	-	-	-	-
	Staff PT Payroll	-	-	-	-	-	-	-
	Fringes	-	-	-	-	-	-	-
	Other	-	-	-	-	-	-	-
	Payroll and Fringes	-	-	-	-	-	-	-
	Operating	-	-	-	-	-	-	-
	Student Help	-	-	-	-	-	-	-
	Capital	-	-	-	-	-	-	-
	Library	-	-	-	-	-	-	-
	Rounding		-		-		-	
	Operating	-	-	-	-	-	-	-
	Total Costs	-	-	-	-	-	-	-
3	Details for Other support	-	-	-	-	-	-	-

Part 7: Letter from University Budget Committee

The UBC has agreed to support this proposal. A letter stating as such is forthcoming.

Part 8: Letter from the Executive Director for Academic Finance

John Carroll
UNIVERSITY

September 16, 2016

Dr. Peifang Tian
Chair, Faculty Council Committee on Academic Policies
Associate Professor, Department of Physics

Re: Proposed Minor in Actuarial Science

Dear Dr. Tian:

I have reviewed the budget for the proposed minor in Actuarial Science. Based upon the results of my review, I believe that this budget was prepared in accordance with JCU budget guidelines and that this budget is realistic.

The projected revenue was prepared on an incremental basis. As in any start-up operation, whether the projected revenue will materialize depends on many factors, including the merit of the program itself and how the program is executed. Although the projected incremental revenue is modest, there is potential for this program to grow tremendously and supplement the current mathematics and computer science programs. The number of students signing up or attending classes for this program will demonstrate the demand.

It should be noted that the proposed budget for incremental operating expenses (payroll, fringes and departmental costs) is zero, because all the courses required for this minor programs are already being offered currently. Consequently, a modest net contribution margin is expected in year one.

In summary, I believe that this program will enrich John Carroll University with a minimal investment. I wish to express my enthusiastic support.

Please do not hesitate to contact me if you have any questions.

Sincerely,

David Wong

David W. Wong, CPA
Executive Director of Academic Finance

cc – Dr. Brendan Foreman and Dr. Paul Shick

Part 9: Letters from Enrollment Division

✛John Carroll
U N I V E R S I T Y

To:	Dr. Barbara K. D'Ambrosia, Chair, Faculty Council
From:	Dr. Brian Williams, VP for Enrollment & Institutional Analytics
Date:	September 12, 2016
Re:	Support for a minor in Actual Science

Please consider this document as an endorsement from our Undergraduate recruitment efforts in support of a minor in Actuarial Science.

The program narrative for this new minor speaks well of this minor's alignment with career outlook data. As further evidence, we know from federal bureau of labor statistics (http://www.bls.gov/ooh/math/actuaries.htm) that there is an expected 18% growth in jobs in as actuaries now to 2024. The timing of this minor in peak with this growing demand curve can be quite beneficial to JCU. Further, as many actuaries reside in the insurance industry, our regional and alumni ties within Progressive Insurance as a key regional player can really open opportunities for jobs, career pathways and more. Adding that value into the functioning of the minor will be powerful for our students.

From a student demand perspective, a minor in actuarial sciences has the potential to attract current students across our math programs and in the Boler school to considering adding this as a minor to help them take their broad major interests into an area of specialty. Additionally, our ability to market the links to the insurance industry and ways to show the value of extending a Math or Economics degree into a specialized area with this minor will further have the ability to attract new students.

If I can elaborate any further on these comments, please do not hesitate to reach out.

Sincerely,

Brian G. Williams

Brian G. Williams
Vice President for Enrollment

Ccs:
Dr. Margaret Farrar
Dr. Brendan Foreman

Part 10: Letters of Support

Department of Mathematics and Computer Science
1 John Carroll Boulevard
University Heights, Ohio 44118-4581
Phone 216.397.4351
Fax 216.397.3033
http://www.jcu.edu/math

September 15th, 2016

To the Faculty Council Committee on Academic Policies:

I am writing regarding the proposal for a new Major in Actuarial Science submitted on behalf of the Department of Mathematics and Computer Science by Brendan Foreman. The proposal has my full support and that of the whole department. In my opinion, the proposed program would fill a very real need in a very cost-efficient manner.

Over the last 5 years, prospective university students have displayed increasing interest in careers in actuarial science, perhaps as a result of the profession being consistently ranked in the top 5 of the *Wall Street Journal*'s "Best Careers List." I can attest that over half of the high school seniors who meet with me during campus visits and Admissions events are thinking about careers as actuaries, and among their questions is why we have no program in AS. To this point, I've had to reassure such prospective students that our JCU programs will indeed prepare them well for such careers, citing the many JCU graduates in actuarial positions with regional firms as evidence. Of course, I have not been able to provide such assurance to the students who have not applied to JCU because we've had no AS program among our majors or minors. The proposed AS minor will position us to compete for such students more effectively.

The proposed minor provides an appropriate recognition and credential for the extra academic work that JCU students have always done in preparing for careers in the AS field. Because of this, it involves only existing courses. The minor offers a well-defined pathway through the rather complex career preparation required by the Society of Actuaries.

Because this proposed minor is structured on existing courses, it can be implemented with absolutely zero cost to the university, at least in the short term. Our current faculty members can teach all of the courses required, and the upper-level courses currently have enough seats available to absorb any short-term growth in student numbers without too much difficulty. If the minor were to draw significant numbers of additional students to JCU (enough to force us to consistently offer additional sections of the upper-level courses involved), we would need to add another faculty position in applied mathematics or statistics to handle the additional demands.

If you need any other information or have any questions, please feel free to contact me at 216-397-4352 or at shick@jcu.edu.

Sincerely,

Paul L. Shick
Professor of Mathematics
Chair, Dept. of Mathematics and Computer Science
John Carroll University