

Actuarial Science Program
DEPARTMENT OF MATHEMATICS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Advising Notes for Actuarial Science Majors – Academic Year 2008-2009

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This document is designed to help actuarial science (act sci) majors at the University of Illinois at Urbana-Champaign plan their collegiate programs. It will be of particular use to incoming freshmen and sophomores, but students further along in the program may also benefit from reading this material. There will no doubt be student-specific questions and issues which this document does not answer; if so, please feel free to e-mail me at gorvett@illinois.edu , and I will do my best to respond promptly (and perhaps even accurately!).

The material below is in five sections:

- 1) A **sample four-year class schedule** for an actuarial science major;
- 2) A **listing of courses** particularly relevant for the actuarial science (often abbreviated “act sci”) major, including key prerequisites, and recent frequency of course offerings (i.e., whether offered both the Fall and Spring semesters, or just one or the other);
- 3) **Courses required** for the actuarial science major;
- 4) The relationship between U of I courses and the **professional actuarial exams**; and
- 5) **Key principles for incoming freshmen**.

It is my fervent wish to meet and get to know each of you throughout your stay in our program. I and the other actuarial science faculty and staff will do our best to help you prepare for what can be a wonderful and satisfying career.

Section 1: Sample Four-Year Schedule of Key Courses

The table below provides a sample, typical four-year plan for the key courses associated with an undergraduate actuarial science degree at the University of Illinois. I have not included electives and general education requirements – selections of those courses are largely personal, and are generally spread across the program in a manner consistent with the individual student’s interests, desired course load each semester, etc. In this table, I have focused on the key act sci and related courses. Specific required math, act sci, and finance courses are included, along with a few others (e.g., see discussion of Economics in part (2) of Section (5) below).

This table is not rigorous – there is some flexibility in the timing of courses. For example, assuming prerequisites are met, there is no problem with a student reversing the orders of the Math 470-level courses in the junior and senior year. Also, many students enter UIUC with credit for one or more calculus courses, which would naturally alter the table below, and accelerate the taking of certain math courses. But I would definitely suggest that, as a general rule, an incoming student attempt to take at least the courses listed in the freshman and sophomore years by the end of her/his second year in the program, along with as many general education courses as is reasonable.

Year	Fall Semester	Either Fall or Spring Semester	Spring Semester
Freshman	Math 220 or 221 Econ 102	CS 101 / 105 / 125	Math 231 Econ 103
Sophomore	Math 241	Math 210 Accy 200	Math 408
Junior	Math 409 Math 471 Fin 230 Fin 221		Math 472 Math 410 Fin 300
Senior	Math 476 Fin 321	Fin/Econ Elective	Math 478 Math 469

Section 2: Listing of Key Courses

The material below identifies the key courses related to the actuarial science major, along with important prerequisites and the frequency with which the courses have been offered in recent academic years (F = Fall semester, S = Spring semester; we generally do not offer act sci courses in the summer, although some basic math, finance, and econ courses may be offered then).

Probably the two key “sequences” of courses (by “sequence,” I mean that each course in the sequence is a prerequisite for the next course in the sequence) for actuarial science majors are:

- Math 220/1 → Math 231 → Math 241 → Math 408/461 → Math 409.
- Accy 200, and Math 408 or 461 → Fin 221 → Fin 300 → Fin 321.

With regard to the Math sequence above, fulfilling a step in this sequence during each semester of your first 2 ½ years (or possibly less, if you have advanced placement credit for the early calculus classes) should be your highest priority early in the program. Another priority during that timeframe is to take an accounting course, which is a prerequisite for beginning the Fin 221-300-321 sequence. This sequence is discussed further in Section (5).

Most of the courses below are worth 3 credit hours, although some are worth either 4 or 5. The credit hours for courses are listed in the university catalog and in the timetable, both of which are online at <http://courses.uiuc.edu/cis/index.html>. (Courses listed in **bold** are, for all intents and purposes, required for the act sci majors, while courses in italics are courses which may be taken to fulfill certain “select one or two courses from this group” requirements. Other courses are listed because they are either prerequisites for required courses, or they are useful or common electives for act sci students.)

<u>Course #</u>	<u>Course Title</u>	<u>Key Prerequisite(s)</u>	<u>Semester Given (Recently)</u>
Math 210	Theory of Interest	Math 231	F, S
Math 220	Calculus I	----	F, S
Math 230/1	Calculus II	Math 220/1	F, S
Math 241/2	Calculus of Several Variables	Math 231	F, S
Math 408	Actuarial Statistics I	Math 241	S
Math 409	Actuarial Statistics II	Math 408	F
<i>Math 410</i>	<i>Linear Algebra & Fin Apps</i>	<i>Math 241, Math 210</i>	<i>S</i>
<i>Math 415</i>	<i>Applied Linear Algebra</i>	<i>Math 241</i>	<i>F, S</i>
Math 469	Methods of Applied Statistics	Math 408	F, S
Math 471	Actuarial Theory I	Math 408, Math 210	F
Math 472	Actuarial Theory II	Math 471	S
Math 476	Actuarial Risk Theory	Math 408	F
<i>Math 477</i>	<i>Casualty Actuarial Science*</i>	<i>Math 408</i>	<i>(occasional)</i>
Math 478	Actuarial Modeling	Math 408	S
<i>Math 490</i>	<i>Advanced Topics in Mathematics**</i>	----	<i>(occasional)</i>
<i>CS 101 / 105</i>	<i>Introduction to Computing</i>	----	<i>F, S</i>
<i>CS 125</i>	<i>Intro to Computer Science</i>	----	<i>F, S</i>
<i>Econ 102</i>	<i>Microeconomic Principles</i>	----	<i>F, S</i>
<i>Econ 103</i>	<i>Macroeconomic Principles</i>	----	<i>F, S</i>
<i>Econ 302</i>	<i>Intermediate Microecon. Theory</i>	<i>Econ 102</i>	<i>F, S</i>
<i>Econ 303</i>	<i>Intermediate Macroecon. Theory</i>	<i>Econ 103</i>	<i>F, S</i>
Fin 221	Corporate Finance	----	F, S
<i>Fin 230</i>	<i>Introduction to Insurance</i>	----	<i>F</i>
Fin 300	Financial Markets	Fin 221	F, S
Fin 321	Advanced Corporate Finance	Fin 300	F, S
<i>Fin 431</i>	<i>Property-Liability Insurance</i>	<i>Fin 230</i>	<i>S</i>
<i>Fin 432</i>	<i>Managing Fin Risk for Insurers</i>	<i>Fin 300, Math 409</i>	<i>S</i>
<i>Fin 434</i>	<i>Employee Benefit Plans</i>	<i>Fin 300</i>	<i>F</i>

* The Math 477 course number is being redefined – at one time it was “Survival Analysis,” but it has now been approved as “Casualty Actuarial Science.” Future offerings of this course are dependent upon the availability of faculty resources.

** Occasionally, a section of Math 490 is offered which can be considered an acceptable replacement for 470-level courses required for the act sci major. Some such 490 sections

might be, for example, Pension Mathematics, or Financial Mathematics. Future offerings of such sections are dependent upon the availability of faculty resources.

Section 3: Courses Required for the Actuarial Science Major

Other than general education and overall credit hour requirements, the specific course requirements for the actuarial science major can be identified in six categories, as follows:

- (1) Calculus (Math 220/1, 231, and 241)
- (2) One of CS 101, CS 105, or CS 125 (CS 101 or 105 recommended)
- (3) Required actuarial science / mathematics core courses:
 - Math 210
 - Math 408 (or 461)
 - Math 409
 - Math 410 or 415***
 - Math 469 (also fulfills VEE in applied statistics – see Section 5(2) below)
 - Math 471
- (4) Three of the following advanced actuarial science courses are required:
 - Math 472
 - Math 476
 - Math 477
 - Math 478

(One of these can be replaced by a special topics Math 490 course – e.g., financial mathematics – if approved by the actuarial science advisor.)
- (5) Required finance courses:
 - Fin 221 (also fulfills VEE in finance – see Section 5(2) below)
 - Fin 300
 - Fin 321 (also fulfills VEE in finance – see Section 5(2) below)
- (6) Two additional courses are required, chosen from the following:
 - Econ 302
 - Econ 303
 - Fin 230
 - Fin 431
 - Fin 432
 - Fin 434
- (7) Other comments
 - Accy 200 – required as a prerequisite for Fin 221. (Accy 201 also OK)
 - Stat 400 and 410 is an acceptable replacement for Math 408 and 409 (although this replacement requires the signed approval of the program director).
 - Econ 102 and 103 are recommended (and fulfill VEE in economics – see 5(2)).

*** Math 410 is a new course, intended to replace the previous Math 415 requirement for act sci majors. This course covers linear algebra in an actuarial and financial context. It is being offered for the first time in Spring 2009, and is preferable to Math 415 for act sci majors.

Section 4: Relationships Between U of I Courses and Professional Actuarial Exams

Although not part of the formal degree requirements, those act sci students who are planning to undertake an actuarial career should consider the taking of national actuarial exams to be a core component of their preparation. In fact, students might want to plan their course schedules with the exams in mind – e.g., some students consider taking a slightly lighter load in those semesters when they are planning to study for and take an exam. Also, students are advised to take (for one credit hour) or sit in on the Math 370 section dealing with the exam they plan to take – these once-per-week evening sessions typically involve going over problems from past examinations, and can be very helpful in preparing for an exam. (We currently offer sections of Math 370 for exams 1/P and 2/FM each semester; occasionally, we also may be able to make arrangements for sessions dealing with exams MLC and/or MFE and/or 4/C in the future.)

At the UIUC, we strive to teach the material that is on the five preliminary actuarial examinations (Exams P, FM, MLC, MLE, and C). The following describes how the exams and UIUC courses line up:

- **Exam 1 / P: Probability (with supporting calculus).** Relevant courses are calculus through **Math 241, and Math 408**. Based on the sample four-year schedule provided in Section 1, a student may want to aim for taking Exam 1 by the end of the sophomore year.
- **Exam 2 / FM: Financial Mathematics.** The relevant course for the interest rate material is **Math 210**; additional financial economics material on this exam can be learned through some combination of independent study, taking or sitting in on Math 370 (Section Z) review sessions, and/or a finance course. A student could be ready to take Exam 2 by his/her sophomore year (or freshman year, if the student enters with sufficient calculus credit). Note that you may take the actuarial exams in any order – e.g., exam 2 can be taken before exam 1, if your course schedule makes it logical to do so.
- **Exams MLC, MFE, and 4 / C: Actuarial Models and Modeling.** These exams deal with material covered in U of I courses Math 471, 472, 476, and 478. Our aim is generally to teach the Exam **MLC material in Math 471 and 472**, the **MFE material in Math 476**, and the Exam **4 / C material in Math 478**. Depending on the timing and selection of courses, a student could possibly take one or more of these exams in their junior or senior years.

In summary, and approximately:

- Exam 1 / P: Math 408
- Exam 2 / FM: Math 210
- Exam MLC: Math 471 and 472
- Exam MFE: Math 476
- Exam 4 / C: Math 478

Some additional information about the actuarial exams:

- Exams MLC, MFE, and 4/C are each given twice per year, once in (generally mid- to late-) May, and once in (generally early) November. Note that this means that the exams

occur several weeks before the end of the Fall semester, but generally around or after the end of the Spring semester. Thus, a UIUC course being taken in the Fall semester which covers material that is critical to an exam will not have been completed by the time of the November administration of the exam, meaning the student might have to “study ahead” in the course in order to cover the material by the time of the exam (alternatively, s/he could wait for the Spring offering of the exam).

- Exam 1/P is given via computer, currently five times per year (basically, in February, May, July, September, and November). Exam 2/FM is also now given via computer, currently two times per year (basically, in May and November), although that frequency may increase in the future, after May 2009.
- All five of these basic exams (P, FM, MLC, MFE, and C) are given on-campus.
- Exams 1/P, 2/FM, 3F/MFE, and 4/C are currently co-sponsored by the Casualty Actuarial Society and the Society of Actuaries. Exam MLC is a Society of Actuaries exam; the corresponding CAS exam, Exam 3L, has some of the same material as this exams, but there are also many differences. Our Math 471 and 472 courses reflect the SoA (Exam MLC) material. As of this writing, the CAS grants credit for its Exam 3L when someone has passed the SOA Exam MLC (but not vice versa, as far as I know).
- Exams can be taken in any order – they need not be taken sequentially according to their number or letter designations.
- Our act sci graduates have a wide variety of exam passes when they leave the U of I. The average is probably about two, but many students each year have passed three or even four exams by the time they graduate. I always suggest that students aim for passing (at least) two while in college, but in general, more is better than fewer.

VEE: Another, relatively recent, aspect of professional actuarial education is the Validation by Educational Experience (VEE) requirement. The VEE requirements represent material that used to be tested on actuarial exams. A few years ago, the actuarial societies removed this material from the exams; instead of testing this material, they now require that, prior to getting a professional actuarial designation (i.e., and ASA or an ACAS), one must not only pass certain actuarial exams, but also take university-level classes in the VEE areas, and get a grade of at least a B-minus in each course.

Specifically, the VEE requirements include the topical areas of economics (both micro- and macro-economics, so generally two courses are necessary to fulfill the VEE requirement), finance, and applied statistics. UIUC has had certain of our courses pre-approved as fulfilling these requirements. In particular, taking and receiving a grade of at least B-minus in the following UIUC courses will fulfill the VEE requirements in the three topical areas. These are the relevant courses most likely to be taken by act sci majors:

- *Economics:* Econ 102 and 103 (both are required). (The sequence Econ 302 and 303 also qualifies.)
- *Finance:* Fin 221. (Fin 321 also qualifies.)
- *Applied Statistics:* Math 469.

Currently, there are also exams available to fulfill VEE requirements. Additional information regarding the entire set of VEE requirements can be found at:

Section 5: Key Principles for Act Sci Students

- (1) **Calculus:** Your first priority is to determine where you should be in the three-course calculus sequence (Math 220/1, 231, and 241), and to complete that sequence. One of these courses should be taken each semester, until the sequence is finished (followed by the actuarial statistics courses for which calculus is a prerequisite: Math 408 and 409).
Note: Based on AP or other placement exams, you might enter the program with credit or proficiency acknowledgement for one or more of the calculus courses. This is fine, and means that you can start the program at an advanced point in the calculus sequence. But keep in mind that this is ultimately up to you – advanced placement credit need not be accepted, if you have reasons for not doing so. For example, even though you might be qualified to begin the calculus sequence with Math 231, if for some reason you are uncomfortable jumping into that course your first semester, you can always take Math 221 and build yourself a more comfortable foundation for the later courses. This can sometimes be a tough decision for new students; sometimes the first class meeting or two of a course will suggest that you might be better placed in a later or earlier course in the sequence. You should certainly strive to make that decision within the first week of classes. I suggest you make a point to sit in on the first class or two of each alternative course, look at the syllabi and texts, and then evaluate how you feel.
- (2) **Economics:** While not required for the degree, the vast majority of act sci students do, and should, take Econ 102 and 103 in their freshman year. These are excellent courses to take, providing important insights into economics, as well as some preparation for later finance courses. (As mentioned in the prior section, they also fulfill the economics VEE requirement.)
- (3) **Computer Science:** Almost all act sci students take CS 101 or 105. The CS course requirement is a good one to address in your freshman year. Whichever of these CS courses you take, you will definitely want to become familiar with at least two software packages fairly early on: Microsoft Word (word processing), and Microsoft Excel (spreadsheet). These will serve you well throughout your U of I program, as well as your actuarial (or any other business) career.
- (4) **Theory of Interest:** Math 210 is the first true “actuarial” course you are likely to take. If you have advanced placement in calculus, you might be able to take Math 210 in your freshman year. Your sophomore year is also fine for Math 210 – but from the standpoint of taking a professional actuarial exam sooner than later, you might want to take Math 210 as soon as you can.
- (5) **Finance courses:** Finance 221 is the first in a required three-course finance sequence (Fin 221, 300, and 321). There are a number of prerequisites for Fin 221 listed in the catalog and on the timetable, but some of them are not really appropriate for actuarial science students. Thus, the bottom line for act sci majors is this: before taking Fin 221, you must take Math 408 or 461, and Accy 200 (preferred) or 201. This means that Fin 221 will often not be taken by act sci students until their junior year. That is fine – there are seats set aside for act sci students in all of Fin 221, 300, and 321 – so as long as you

have at least three semesters left in your program, you should be able to take this entire three-course sequence. (As mentioned in the prior section, Fin 221 fulfills the VEE requirement in finance.)

- (6) ***Your Freshman Year:*** Your first year at the U of I – and especially the first semester – will involve a number of new experiences and challenges. College is a different world than you are likely to have been exposed to before. Please bear in mind that many, many students struggle a bit in their first semester in college, and then thereafter they become accustomed to the process and proceed on a path to success.
- (7) ***Utilize your available resources:*** Your family, your friends, faculty, your major advisor (Hi!) – we and many others are all here for you. Make the most of those resources throughout your college years – and we'll all share in your successes with you!