

MA/ST 412-601: Long-Term Actuarial Models

Summer I 2022: Distance Education Course

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Office Hours (via Zoom): MWF 9-10am or by appointment

Course Description

Actuarial science is the discipline that applies mathematical and statistical methods to assess risk in insurance, finance, and other industries and professions. To become an actuary, one must pass a series of specialized exams on actuarial mathematics. This course covers (some of) the material for SOA Exam MLC: Models for Life Contingencies and SOA Exam FM: Financial Mathematics. Specifically, the course covers survival models, life tables, selection, insurance benefits, annuities, premium calculation, and time permitting, multiple state models. We will also introduce and review key concepts from probability theory and interest theory, as needed. The material for this class will cover chapters 1-6 and 8 of the textbook, with extra material from other texts as needed.

Prerequisite

MA 241 or MA 231 (Specifically, computing integrals and working with finite and infinite series).

Corequisite

One of MA 421, BUS[ST] 350, ST 301, ST 305, ST 311, ST 361, ST 370, ST 371, ST 380 (Specifically, material on random variables).

Text

Dickson, Hardy, Waters, *Actuarial Mathematics for Life Contingent Risks*, Cambridge University Press, 2nd Edition, ISBN 13: 978-1107044074. Here is a link to the 1st edition of the book on the library's website: <https://catalog.lib.ncsu.edu/catalog/NCSU2280820>. Only one user at a time is allowed to access it, but you can download chapters of the book as a PDF.

Recommended Text

- Dickson, Hardy, Waters, *Solution Manual for Actuarial Mathematics for Life Contingent Risks*, Cambridge University Press, 2nd Edition
- Kellison, *The Theory of Interest*, (I will provide scans of the first three chapters on the Moodle site, which is all that is needed for this course. However, this book is used for the SOA Exam FM: Financial Mathematics and would be useful to have if you plan to take the actuarial exams to become an actuary.)

Communication

Course announcements, homework assignments, etc. will be posted on Moodle. Your NCSU email address will be used for all communications for the course. Plan to check that email regularly for course announcements, or setup email forwarding to another account you check regularly. Your email is automatically enrolled in the course announcement forum which runs through Moodle. I respond to emails frequently throughout the normal workday, 9 AM - 5 PM. If you send an email after 5 PM you will receive a response the next business day.

Problem Sessions

I will hold problem sessions on Tuesdays and Thursdays from 8-9am. These are optional to attend and will be recorded. The recording will be posted on Moodle later that same day. Even if you do not attend the problems session, I suggest still watching the recording because I will be giving guidance on how to approach homework problems.

Course Objectives

1. State key definitions and formulas in actuarial science.
2. Use actuarial notation and connect it to related notation from probability and statistics.
3. Apply main results in actuarial science of life contingencies to solve freshly encountered problems.

Homework

Homework will be assigned on Moodle weekly and is due at 11:59 PM on Wednesdays and Fridays. See course schedule on Moodle for dates. Homework will be submitted as a PDF through Gradescope. See *Homework Preparation Guidelines* on Moodle for information on how to prepare your homework.

Late Homework

Each student may turn in at most **2 late homework assignments** during the semester for credit. Late homework is due 24hr after the original due date.

Quizzes

Moodle quizzes will be assigned most Mondays, Wednesdays and Fridays and are due at 11:59 PM. You should think of the Moodle quiz as another form of homework. The problems are multiple choice. There is no time limit so you can start and stop working on problems, discuss problems with other students, consult the book or lecture notes as you work, etc. Moodle quiz problems will tend to be numerical and somewhat shorter than the homework problems. There are two attempts per quiz.

Calculators

There are 6 calculator models that are permitted for the Society of Actuaries actuarial exams, all Texas Instruments, in the following models: BA-35, BA II Plus, BA II Plus Professional, TI-30Xa, TI-30X II (IIS solar or IIB battery), TI-30XS MultiView (or XB battery). If you are serious about becoming an actuary, purchase one of these calculators now and plan to use them on our exams and homework. They are all inexpensive and have a relatively limited functionality (e.g., no integrals). You will need a calculator of some sort and should plan to use it as you watch the lectures, work on homework and quizzes, and for exam days.

Exams

There will be two midterm exams and a final exam. The exams are open book. The exams will be administered through Moodle. They will be a combination of fill in the blank, multiple choice, and short answer. On the day of the exam, you will have all day to start the exam but a limited time after you open the exam. The midterm exams are each 75 minutes and the final exam is 150 minutes. Topics covered on each exam can be found in the *Learning Objectives (Exam Study Guide)* document on Moodle. During the exam you may not use the internet or consult with anyone else.

Exam Dates

- Midterm 1: Thursday, June 6
- Midterm 2: Friday, June 17
- Final Exam: Thursday June 23 or Friday June 24

If you have a conflict with the test dates, please let me know as soon as possible. In the event you miss the scheduled exam, due to unforeseen circumstances, your final exam will replace your missed exam.

Getting Help

Bottom line: I want you to succeed. Send me an email and come to office hours. If you cannot meet during my scheduled office hours, please send me an email and we can schedule an appointment. You are responsible for 1) knowing when you're confused 2) doing something about it. Don't wait until the night before a test or the hour before homework is due to ask questions.

Grade Distribution

Component	Percent Value
Homework	10%
Quizzes	10%
Midterm 1	20%
Midterm 2	20%
Final Exam	40%

Letter Grade Distribution: Letter grades will be based on percent values as follows (do not expect any additional rounding or curves):

A+ 97 - 100	A 93 – 96.99	A- 90-92.99
B+ 87 – 89.99	B 83-86.99	B- 80-82.99
C+ 77-79.99	C 73-76.99	C- 70-72.99
D+ 67-69.99	D 63-66.99	D- 60-62.99
F 0 – 59.99		

Counseling Center

It is important to take care of your mental health. The NCSU counseling center at 2815 Cates Ave is open Mondays through Fridays 8am to 5pm. There is a 24/7 emergency hotline at 919-515-2423. If you or a friend is struggling, don't hesitate to reach out.

Diversity, Equity, and Inclusion

Diversity, equity, and inclusion are important to the success of our students at NC State. Every student, every faculty member, and every staff member who comes to NC State enriches us through their varied perspectives, knowledge, and backgrounds. Our classroom is one in which every student is respected and feels heard. To affirm and respect the identities of transgender students in the classroom and beyond, please contact me if you wish to be referred to using a name and/or pronouns other than those listed in the student directory. I welcome any suggestions you have for making our classroom more welcoming and inclusive.

Disability Services

Reasonable accommodations will be made for students with verifiable disabilities. To receive accommodations, students must register with Disability Services for Students at

1900 Student Health Center, Campus Box 7509, 919-515-7653. Here is their link: <https://dro.dasa.ncsu.edu/> (opens in new window). Please see the Academic Accommodations for Students with Disabilities Regulations (REG02.20.1). You must discuss accommodations with me *prior* to a test date.

Electronically Hosted Components

Please be advised this course is being recorded for current and potential future educational purposes. By your continued participation in this recorded course, you are providing your permission to be recorded.

Code of student conduct

Documentation will be submitted to the Office of Student Conduct for students who violate the University Regulations on academic integrity. There can be no graphing calculators used on the tests. No help from any other sources than your own head is allowed during tests (hopefully this is obvious – you are expected to show all your work on your tests papers).

Requirements for Credit-Only (S/U) Grading

To receive a grade of S, students are required to take all exams, complete all assignments, and earn a grade of C- or better. Conversion from letter grading to credit only (S/U) grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details refer to <http://policies.ncsu.edu/regulation/reg-02-20-15>.

Requirements for Auditors (AU)

Information about and requirements for auditing a course can be found at <http://policies.ncsu.edu/regulation/reg-02-20-04>.

Policies on Incomplete Grades

If an extended deadline is not authorized by the instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. See the university policy on incomplete grades:

<http://policies.ncsu.edu/regulation/reg-02-50-3>

Academic Integrity

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct: <http://policies.ncsu.edu/policy/pol-11-35-01>. Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

Non-Discrimination Policy

NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or

NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <http://policies.ncsu.edu/policy/pol-04-25-05> or http://www.ncsu.edu/equal_op/. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148