SYRACUSE UNIVERSITY, SPRING 2019 SYLLABUS

MAT 528, Probability Models for Actuarial Science

General Information

Course Meetings: Mon & Wed 2:15PM - 3:35PM in ***Carnegie 114***.
Instructor: Thomas John, Ph.D.
Contact Information: Office: Carnegie 313D, Phone: 315-443-1587, email: thjohn@syr.edu.
Office Hours: Mon & Wed 10:00AM- 11:30AM.

Special Note on the Drop Deadline:

Academic Drop Deadline and the Financial Drop deadline will both occur on Monday, February 4, 2019 (three weeks from the first day of classes). Students may still withdraw from courses after Feb 4th but before the withdraw deadline Tuesday, April 16, 2019; this would place a "WD" grade on their transcripts.

Course Catalogue Description:

Applied probability focusing on distributions for actuarial applications. Conditional expectation. Moment generating functions. Limit theorems. Loss and Survival models. Parametric and Non-Parametric estimation. Model assessment. Benefit reserves and risk measures. *Additional work required of graduate students*.
Prereq: MAT 521

Course Overview:

The goal of the course is to provide partial preparation towards actuarial exams P (Probability), STAM (Short Term Actuarial Mathematics), and LTAM (Long Term Actuarial Mathematics). The course will focus on applications of probability models in risk/insurance areas. This entails covering some topics that may not have been covered in MAT 521 and extending the topics covered in MAT 521 to specific applications.

Text: Following textbooks will be used as references.

- The study guides available online from Marcel Finan (Arkansas Tech University) available at http://faculty.atu.edu/mfinan/actuaries.html, specifically the guides for Exams P, C, and MLC.
- Loss Models: From Data to Decisions, 4th Ed, Klugman, Panjer, and Willmot; ISBN: 978-1-118-31532-3.
- Introduction to Probability, Blitzstein and Hwang; ISBN: 9781-4665-75578. (MAT 521 textbook).
- *Probability and Statistics*, 4th Ed, DeGroot and Schervish

Grading:

Your final grade will be based on two semester exams (25% each), a cumulative final exam (30%), quiz/HW/class participation (20%). Final letter grades will be given according to the following scale:

A (93-100); A- (90-92); B+ (87-89); B (83-86); B- (80-82);
C+ (77-79); C (73-76); C- (70-72); D (60-70); F (0-59)

Exam Dates:

- Semester Exam 1: Monday, February 18
- Semester Exam 2: Monday, April 8
- CUMULATIVE FINAL EXAM: Thu, May 02, 2019 12:45 PM - 2:45 PM

Special Note on the Final Exam:

All students must take the cumulative final exam at the scheduled time on Thursday, May 2, 2019 12:45 PM - 2:45 PM. There will be no exceptions, and so you should not plan to leave campus before 245 PM on Thursday, May 2, 2019.

(No) Makeup Policy:

There will be absolutely no make-ups for any reason. If you miss a quiz/test for a valid reason (which must be verified by a note from a physician or your dean's office), performance from the corresponding part of a test/final will be used as replacement.

Homework:

Homework will be assigned regularly and some of the problems may be asked to be turned in. You may discuss these problems with other students, but each of you is expected to write up your own solutions independently. The ***best*** way to learn this material is to do homework problems. Try as much as possible to do the homework on your own.

Quiz:

There will be quizzes given frequently. These quizzes will be one or two problems very similar to the examples done in lecture and homework problems. The specifics will be announced in lecture ahead of time.

Attendance:

You are expected to attend every class and every exam. If you miss a class, it is your responsibility to obtain and review/study on your own a copy of the lecture notes for that class. You are also responsible for any announcements about changes to the course schedule, the exam schedule, or the course requirements that were made during that class.

Phone, Laptop, Tablet in class policy:

Phones, laptops, tablets, and similar electronics are not allowed to be out during class. **This policy will be strictly enforced in class. Repeated violations of this policy will be recorded.** Students who repeatedly violate this policy will be asked to leave the room and the overall course grade will be affected by such behavior. Note that 20% of course grade is based on quiz/HW/*class participation*

Calculators:

You will need a calculator to do the computations that will arise throughout the course. No specific calculator is required, but TI-84 or TI-83 graphing calculator is highly recommended. Calculators are not to be shared during exams and quizzes. Also, calculators on cell phones cannot be used on quizzes/tests.

Regardless of the calculator that is being used, calculators with symbolic manipulation capabilities (such as TI-89, TI-92, TI-Nspire CAS etc.) cannot be used to do calculus (differentiation/integration). For any derivatives/integrals, sufficient steps must be shown to receive credit on HW/quizzes/exams.

Students with Disabilities:

If you believe that you need academic adjustments (accommodations) for a disability, please contact the Office of Disability Services (ODS), visit the ODS website http://disabilityservices.syr.edu, located in Room 309 of 804 University Avenue, or call (315) 443-4498 or TDD: (315) 443-1371 for an appointment to discuss your needs and the process for requesting academic adjustments. ODS is responsible for coordinating disability-related academic adjustments and will issue students with documented Disabilities Accommodation Authorization Letters, as appropriate. Since academic adjustments may require early planning and generally are not provided retroactively, please contact ODS as soon as possible. Making arrangements with ODS takes time. Do not wait until just before the first test. Students taking exams at ODS should take them at times which overlap the exam time for the rest of the class.

Religious observances policy:

SU religious observances policy recognizes the diversity of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holidays according to their tradition. Under the policy, students are provided an opportunity to make up any examination, study, or work requirements that may be missed due to are religious observance provided they notify their instructors

before the end of the second week of classes. For SPRING and spring semesters, an online notification process is available through MySlice (Student Services > Enrollment > My Religious Observances) from the first day of class until the end of the second week of class.

Related link:
https://policies.syr.edu/policies/university-governance-ethics-integrity-and-legal-compliance/religious-observances-policy/.

Academic Integrity:

Syracuse University's Academic Integrity Policy reflects the high value that we, as a university community, place on honesty in academic work. The policy defines our expectations for academic honesty and holds students accountable for the integrity of all work they submit. Students should understand that it is their responsibility to learn about course-specific expectations, as well as about university-wide academic integrity expectations. The policy governs appropriate citation and use of sources, the integrity of work submitted in exams and assignments, and the veracity of signatures on attendance sheets and other verification of participation in class activities. The policy also prohibits students from submitting the same work in more than one class without receiving written authorization in advance from both instructors. Under the policy, students found in violation are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered as described in the Violation and Sanction Classification Rubric. SU students are required to read an online summary of the University's academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice.

Specifically for this course, the academic integrity aspects relate to quizzes/exams. A student is not allowed to use ANY electronic device except for their calculator during the quiz/exam until the quiz/exam is handed in. Accessing material beyond standard calculator functionalities and any statistical table provided during the quiz/exam will be a violation of academic integrity.

The Violation and Sanction Classification Rubric establishes recommended guidelines for the determination of grade penalties by faculty and instructors, while also giving them discretion to select the grade penalty they believe most suitable, including course failure, regardless of violation level. Any established violation in this course may result in course failure regardless of violation level.

Related link: http://class.syr.edu/academic-integrity/policy/

Learning Objectives:

After taking this course, students will be able to:

- calculate, estimate, and manipulate probabilities and random variable distributions commonly used in risk/insurance areas;
- conduct, with and without the aid of technology, probability model determinations and assessments;
- interpret the output of statistical software;
- choose appropriate mathematical models to solve actuarial problems.

Notes about Actuarial Exam Preparation: While exam 1/P is based mostly on MAT 521 topics, the actuarial exam questions expect a much deeper understanding of the material and the ability to manipulate the relationships between different quantities of interest at a quick pace. Similarly, other actuarial exam questions expect a solid familiarity with the corresponding topics and terminology.

In the introduction to ASM study manual for Exam P, the author Prof. Ostaszewski introduces the following rule:

Fundamental Rule for Passing Actuarial Examinations: You should greet every problem you see when you are taking the exam with these words: "Been there, done that." There is simply not enough time to think on the exam. Thinking is always the last resort on an actuarial exam. You may not have seen this very problem before, but you must have seen a problem like it before. If you have not, you are not prepared.

As such, it will require the student to put in dedication through this course *and* **extensive preparation beyond this course** on their own to successfully pass the examinations. This course is only meant as an introduction to the foundational probability topics behind the problems that appear in these exams. It is unrealistic in a semester course to work through every particular type of problem that could show up. It is the student's responsibility to complement this course with individual practice/preparation after this course preparing for the exams.

Tentative Course Calendar:

Week	**Topics**
Week of Jan-14	Review of rules of probability, counting, Venn-diagrams Conditional probability, independence, and Bayes rule
Week of Jan-21	Review of commonly used univariate (discrete/continuous) distributions
Week of Jan-28	CLT and Normal Approximation to Binomial
	Models incorporating deductibles, policy limits, and premiums.
Week of Feb-04	Bivariate distributions; Transformations of RV's; Distributions of max/min of IID RV's
	Conditional Expectation/Variance, Wald's Identity, Law of Total Variance, and Random Sums
Week of Feb-11	Aggregate loss and approximations
	Moment Generating functions and Joint MGF's; Inequalities (Markov, Chebyshev, and Chernoff).
Week of Feb-18	Exam 1 (**Exam 1 on Monday, February 18**)
	Loss/Severity and frequency models: Extensions of distributions learned in 521
Week of Feb-25	Generating new distributions by scaling/powers/exponentiation
Week of Mar-04	Specific families (linear exponential, (a, b, 0), (a, b, 1)), aggregate loss approx revisited.
Week of Mar-11	***Spring Break***
Week of Mar-18	Survival models: Age-at-death and time-until-death random variables, force of mortality
Week of Mar-25	Specialized distributions used in actuarial science (Gompertz, Makeham, Weibull)
Week of Apr-01	Non-parametric Estimation of models (Kaplan-Meier, Nelson-Aalen)
Week of Apr-08	Exam 2 (**Exam 2 on Monday, April 8**)
	Parametric Estimation of models (MME, MLE)
Week of Apr-15	Model assessment/selection: Chi-Sq. GOF, Kolmogorov-Smirnov, Anderson-Darling
Week of Apr-22	Computations of premiums, reserves, risk measures (variance premium, Value-at-Risk, tail-VaR)
Week of Apr-29	Wrap-up **Cumulative final exam: Thursday, May 2, 2019 12:45 PM - 2:45 PM**