Department of Mathematics & Statistics
Concordia University

ACTU 491 (MAST 729/MAST 881), Sec. M

Topics in Actuarial Mathematics

Winter 2021

Preface: **Due to exceptional circumstances, this course will be taught and all assessments will be done completely ONLINE**.

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Class Schedule: Wednesdays and Fridays, 4:15-5:30 pm. Courses, exams and office hours are all held online.

Office Hours: Monday 10:00-11:30 am, Tuesday 2:30-4:00 pm. Zoom link will be accessible through the course Moodle page.

Texts: There is no required textbook. However, part of the course material is inspired by the following two books.

1) *The econometrics of individual risk: credit, insurance, and marketing,* by C. Gourieroux and J. Jasiak, 2007 Princeton University Press.
2) *Regression Modeling with Actuarial and Financial Applications,* by Edward Frees, Cambridge University Press.

Outline: This course is an introduction to the analysis of individual risks encountered in various insurance and credit risk contexts, such as risk scoring and pricing, capital reserving, marketing, claims management and fraud detection. In the past, modeling techniques for insurance and credit risks have been developed separately, and the aim is to put together an inventory of relevant results on such individual risks that are currently scattered in these two domains. The emphasis will be put on the specificities of data encountered in both domains, which are most of the time highly non-normal, often discrete or mixed.

There is no prerequisite for previous actuarial science or finance training, but a reasonable understanding of undergraduate mathematical statistics, such as linear regression models, is expected. Previous exposure to the R language is expected.

For Actuarial Science students: This course is designed as complementary to STAT 380, Statistical Learning, but is not a formal preparation for Society of Actuaries Exams such as Predictive Analytics, as we will try to cover both insurance and finance examples. However, special attention will be paid to the implementation of the models using the R language and the material covers a significant portion of the curriculum of the PA exam, especially on data visualization and (the implementation of) generalized linear models.

Tentative Schedule:

Chapter 1: An overview on Insurance/finance data and segmentation.

Chapter 2: Discrete-valued risks 1: count-valued risks: Poisson models, Poisson regression, Negative binomial models, Pseudo-likelihood estimation, Bonus-malus pricing, applications in non-life insurance.

Chapter 3: Continuous-valued risks I: positive risks: gamma model, Pareto model, gamma/Pareto regressions, applications in non-life insurance.

Chapter 4: Discrete-valued risks II: dichotomous risks: polytomous risks. Logistic regression, performance curves, multinomial logit regression, applications in insurance and credit risk.

Chapter 5: Continuous-valued risks II: bounded risks: beta regression, fractional response models, application to credit risk.

Chapter 6: Continuous-valued risks III: durations. Proportional hazard models, frailty models. Applications to lapse and mortality risks.

Evaluation:

The total score is determined according to the following rule:
4 assignments (70%), mid-term (10%) and final exam (20%).

The assignments will be mainly data analysis, or literature review. Exams will be a mixture of theoretical questions and practical ones, such as interpreting outputs of statistical software, or simple codes.

The assignments will be due approximately once every three weeks, they may include both theoretical and computational exercises. Your assignment solutions must be uploaded through Moodle as a single PDF document.

The mid-term will be held online during scheduled class time; the final exam will be held online during the final exam period.

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

Academic Integrity and the Academic Code of Conduct
This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: concordia.ca/students/academic-integrity." *[Undergraduate Calendar, Sec 17.10.2]*

Behaviour
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