

Casualty & Health Insurance Mathematics

ACTSC 625, Winter 2014

Instructor: Ruodu Wang, M3 3122, ext.31569, wang@uwaterloo.ca
Lectures: 1:30 – 3:20 Tuesdays and Thursdays, M3 2101.
Office hours: 3:30 – 4:30 Tuesdays and Thursdays, or by appointment.
You are welcome to knock at my office at any time,
and if I am **not busy** I will be happy to answer your questions.

Reference

The primary source of material will be Loss Models, by Klugman Panjer Willmot (Wiley, fourth edition). This will be supplemented by powerpoint slides, class notes and additional reading.

Homework

I plan to set four individual assignments. The assignments will not be equally weighted. All assignments will contribute to your coursework grade. Assignments should be handed in to the instructor by the end of the class on the due day. Late assignments are not acceptable.

Midterm

One midterm is scheduled at the lecture time (tentatively) on Thursday, Feb 27.

Course Evaluation Breakdown

- (1) Assignments 20%;
- (2) Midterm 15%;
- (3) Final Examination 65%.

Course Objectives

At the end of this course, students should be able to

- Describe standard features of non-life insurance and re-insurance policy design.

- Understand and work with standard frequency and severity models for insurance losses.
- Determine the impact of deductibles and reinsurance on the models and estimation.
- Understand and calculate moments and probabilities for compound distributions, especially compound Poisson, compound binomial, and compound negative binomial.
- Apply Bayesian estimation to loss models.
- Understand and calculate Buhlmann-Straub and exact Credibility premiums.
- Understand principles of claims reserving for non-life insurance, using run-off triangle methods.
- Understand introductory ruin theory.

Course Topics and Tentative Schedule

There may be changes.

Lecture	Date	Topic	Book chapters
Lecture 1	Tue 7/1/14	Introduction to P&C, health and reinsurance	note
Lecture 2	Thu 9/1/14	Loss severity distributions - models and transformations	3
Lecture 3	Tue 14/1/14	Loss severity distributions - estimation	13
Lecture 4	Tue 16/1/14	Loss severity distributions - model selection	16
Lecture 5	Tue 21/1/14	Loss frequency distributions and processes 1	6
Lecture 6	Thu 23/1/14	Loss frequency distributions and processes 2	6
Lecture 7	Tue 28/1/14	Aggregate claims models 1	9
Lecture 8	Thu 30/1/14	Aggregate claims models 2	9
Lecture 9	Tue 4/2/14	Aggregate claims models 3	9
Lecture 10	Thu 6/2/14	Bayesian estimation	15
Lecture 11	Tue 11/2/14	Credibility and experience rating	17
Lecture 12	Thu 13/2/14	Credibility - Bayesian	18
Week 7	17/2/14-21/2/14	READING WEEK	
Lecture 13	Tue 25/2/14	Review	
Lecture 14	Thu 27/2/14	Midterm	
Lecture 15	Tue 4/3/14	Credibility - Buhlmann-Straub	18
Lecture 16	Thu 6/3/14	Impact of policy modifications	note
Lecture 17	Tue 11/3/14	Reserves	note
Lecture 18	Thu 13/3/14	Ruin Theory 1	note
Lecture 19	Tue 18/3/14	Ruin Theory 2	note
Lecture 20	Thu 20/3/14	Selected topics: risk measures	3
Lecture 21	Tue 25/3/14	Selected topics: dependence	note
Lecture 22	Thu 27/3/14	Selected topics: reinsurance	note
Lecture 23	Tue 1/4/14	(flexible)	
Lecture 24	Thu 3/4/14	Review	

Notes

Course webpage: All the course materials will be posted on the D2L course webpage <https://learn.uwaterloo.ca/>.

Attendance to classes is strongly recommended. If you missed, it is your own responsibility to get known of all the mathematical knowledge and announcements made in classes. Unless you have legitimate excuse for your absence, it will be impossible to get a copy, from the instructor afterwards, of those course materials you missed.

Collaboration. You may discuss assignments, but you should write up solutions separately, without access to any other students' solutions, unless the assignment is specifically set as a group assignment. Rules for group assignments will be explained when they are assigned.

Requests for re-grading an exam must be made within one week after the grades have been posted on course webpage. To have your assignment/exam considered for re-grading, the assignment/exam must be written in ink. Note that the instructor reserves the right to re-grade the entire exam and raise or lower the grades originally assigned.

Missed an exam. If you missed the midterm or the final exam without a legitimate excuse, you get zero grade. If you know that you are going to be absent, you should ask the instructor in advance for the permission. Examples of an excused absence include participation in the University sponsored activities (e.g. varsity sport, debate team), observance of officially designated religious holidays, serious personal problems (illness, etc) and matters relating to students' academic training (e.g. graduate or professional school interviews). Conflicts arising from personal travel plans or social obligations do not qualify as excused absences.

Illness. If an illness prevents you from completing an examination, the University's rules stated in the Accommodation for Illness Policy will apply; see the following link http://www.registrar.uwaterloo.ca/students/accom_illness.html.

It is your responsibility to familiarize yourself with this policy. To be excused for your absence due to illness, the student need to present a "Verification of Illness Form" filled out and signed by a physician (automatically done if you go to the campus clinic) to your instructor within 3 working days of the exam. You also need to send an email to the instructor within 24 hours of the exam to let us know that you were unable to write the exam. You should be aware that presenting the Verification of Illness Form within the above deadlines does not guarantee that you will be excused from the exam.

No make-up exams. If you missed the midterm and your absence is well excused, the weight of the midterm will be shifted to the final exam. There are no make-up midterm. If you miss the final exam and present satisfying evidence as above, a make-up exam will be given to you. You will receive a 24-hour notice by email (using the email address that you used to let us know about your absence from the exam) giving you the time and location of the make-up final exam. The make-up final exam will be scheduled at a time that does not conflict with your other exams. An INC grade is only given in very exceptional circumstances, when a student is unable to write exams in the remaining exam period (and has documented evidence of that), had maintained an average of at least 70% in the course, and had missed no midterm.

UW Academic Policies

Persons with Disabilities: The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132 collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with OPD at the start of each academic term.

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, <http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm>.

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about rules for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71-Student Discipline. For information on categories of offenses and types of penalties, students should refer to Policy 71-Student Discipline, <http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm>.

Avoiding Academic Offenses: Most students are unaware of the line between acceptable and unacceptable academic behavior, especially when discussing assignments with classmates and using the work of other students. For information on commonly misunderstood academic offenses

and how to avoid them, students should refer to the Faculty of Mathematics Cheating and Student Academic Discipline Policy, [http://www.math.uwaterloo.ca/navigation/Current/cheating policy.shtml](http://www.math.uwaterloo.ca/navigation/Current/cheating%20policy.shtml)[http://www.math.uwaterloo.ca/navigation/Current/cheating policy.shtml](http://www.math.uwaterloo.ca/navigation/Current/cheating%20policy.shtml).

Appeals: A student may appeal the finding and/or penalty in a decision made under Policy 70 - Student Petitions and Grievances (other than regarding a petition) or Policy 71 - Student Discipline if a ground for an appeal can be established. Read Policy 72 - Student Appeals, <http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm>.