Topics in Quantitative Risk Management
ACTSC 964, Winter 2020

Instructor:	Ruodu Wang, M3 3122, ext. 31569, `wang@uwaterloo.ca`
Lectures:	1:00 – 2:20 Tuesdays and Thursdays, M3 3103.
Tutorials:	N/A
Office hours:	4:00 – 5:00 pm Monday and Wednesdays, or by appointment.
	You are welcome to drop by my office at any time,
	and if I am not occupied I will be happy to answer your questions.
Target audience:	Ph.D. students and Master's students
	in Actuarial Science, Quantitative Finance, or Statistics

Objectives

At the ASTIN meeting in 2005, Professor P. Embrechts (ETH Zurich, Switzerland) referred to those actuaries working in enterprise risk management as *actuaries of the fourth kind*. Thus, the knowledge of risk management becomes crucially important for modern actuaries.

In this course, we study fundamental concepts in quantitative risk management (QRM). Topics include: basics of risk management and regulation, risk measures, financial time series, extreme value theory, copulas, multivariate distributions, risk aggregation, and applications. This course should be treated as a mathematical course.

The course contents have a considerable overlap with those of ACTSC445/845, with a different focus. If you have already taken 445/845, I recommend you not to take this course, and to take some more specialized courses instead.

References

The course slides and other materials are available on Learn.

[1] There is a main reference book

  (i) McNeil, A. J., Frey, R. and Embrechts, P. (2015). *Quantitative Risk Management: Concepts, Techniques and Tools.* Revised Edition. Princeton, NJ: Princeton University Press.

[2] Materials are available on a third-party website

    (ii) QRM Tutorial: `http://qrmtutorial.org`.

[3] Recommended reading

    (iii) Föllmer, H. and Schied, A. (2016). *Stochastic Finance.* 4th edition, De Gruyter.

Test materials are based on lecture notes. Some chapters in the lecture notes will not be discussed, and this will be made clear during the lectures.

Assignments

I plan to set two individual question-solving assignments. The assignments will be equally weighted. Assignments should be handed in to the instructor no later than the end of the class on the due day. Late assignments are not acceptable.

Midterms

Two midterms are planned. Tentative schedule:

(1) lecture time on Tuesday, February 25th (13th lecture), 2020.

(2) lecture time on Tuesday, April 2nd (24th lecture), 2020.

Essay and presentation

Towards the end of the term, each student will write an essay about recent developments of a specific QRM topic based on reading one or a few research papers. Depending on the number of students in the class, the students may work in groups, and there may be a presentation during lecture times.

Course Evaluation Breakdown

(1) Assignments, 20%;

(2) Midterm #1, 25%;

(3) Midterm #2, 25%;

(4) Essay (and presentation) 30%.

Tentative Schedule

	Lectures	Topics	Chapter
Part I	1-6	**Introduction to QRM**	
		Risk in perspective	1
		Basics concepts in risk management	2
		Empirical properties of financial data	3
Part II	7-12	**Methods for univariate risks**	
		Financial time series	4
		Extreme value theory	5
		Scaler measures of risk	8
		Lecture 13: Midterm #1	
Part III	14-20	**Methods for multivariate risks**	
		Multivariate models	6
		Copulas and dependence modeling	7
		Risk aggregation and allocation	8
Part IV	21-23	**(If time allows, usually not)**	
		Other topics	9 - 11
		Students presentation	
		Lecture 24: Midterm #2	

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Lecture content, spoken and written (and any audio/video recording thereof); Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides); Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner). Course materials and the intellectual property contained therein, are used to enhance a student's educational experience. However, sharing this intellectual property without the intellectual property owner's permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

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Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

Relevant University Policies:

Policy 71 - Student Discipline   Policy 73 - Intellectual Property Rights