

# Topics in Quantitative Risk Management

## ACTSC 964, Winter 2018

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**Instructor:** Ruodu Wang, M3 3122, ext. 31569, wang@uwaterloo.ca  
**Lectures:** 1:00 – 2:20 Tuesdays and Thursdays, M3 3103.  
**Office hours:** 2:30 – 3:30 Tuesdays and Thursdays, 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.

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### 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, 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, and they can also be found on a third-party website: <http://qrmtutorial.org>.

[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] Recommended reading

(ii) 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 will contribute to your coursework grade. 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 Thursday, February 15th (13th lecture), 2018.
- (2) lecture time on Tuesday, April 3rd (24th lecture), 2018.

### **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
<b>Part I</b>	1-6	<b>Introduction to QRM</b>	
		Risk in perspective	1
		Basics concepts in risk management	2
		Empirical properties of financial data	3
<b>Part II</b>	7-12	<b>Methods for univariate risks</b>	
		Extreme value theory	5
		Scaler measures of risk	8*
Lecture 13: Midterm #1			
<b>Part III</b>	14-20	<b>Methods for multivariate risks</b>	
		Multivariate models	6
		Copulas and dependence modeling	7
		Risk aggregation and allocation	8
<b>Part IV</b>	21-23	<b>(If time allows)</b>	
		Other topics	9 - 11
		Students presentation	
Lecture 24: Midterm #2			

\*supplemented by additional materials