

# MATH 588 – Advanced Quantitative Risk Management

## Course Description from Bulletin: (3-0-3)

This is an advanced course on quantitative risk management. The major concepts and ideas from the modern risk management will be explained and illustrated. The course builds upon general theory of risk measures and performance measures and addresses the current regulatory requirements for market participants. (3-0-3)

**Enrollment:** Elective for AM and other majors

**Textbook(s):** Alexander J. McNeil, Rüdiger Frey & Paul Embrechts, *Quantitative Risk Management Concepts, Techniques and Tools*, Princeton University Press, First Revised Edition, 2015, ISBN9781400873210

**Other required material:** None

**Prerequisites:** MATH 474 or 475 or equivalent.

## Objectives:

1. Students will understand the basic principles of quantitative risk management such as measuring the risk and measuring the performance of financial positions.
2. Students will understand the role of choosing a particular risk measure or performance measure to monitor the overall risk profile of a financial position/institution.
3. Students will learn various mathematical techniques for modeling portfolio value.
4. Students will understand the abstract mathematical concepts in defining a risk measure or a performance measure.
5. Students will understand how to apply the quantitative risk management methodologies to market data.
6. Students will work on projects by developing Python scripts to compute the risk-performance profile of financial positions by using market data.

**Lecture schedule:** 3 50 minute (or 2 75 minute) lectures per week

## Course Outline:

	Hours
1. Basic concepts in risk management	6
a. History of risk management and contemporary regulatory framework	
b. Modeling portfolio value and its change (basic concepts)	
c. Value-at-risk, expected shortfall and other risk measures	
2. Modeling portfolio value and its change	10
a. Empirical properties of financial data	
b. Financial time series	
c. Extreme value theory (optional)	
d. Multivariate models and copulas	
3. Theory of risk and performance measures	10
a. Coherent and convex risk measures	
b. Performance measures	

- c. Aggregation and capital allocation
- 4. Applications
  - a. Market risk
  - b. Credit risk

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<b>Assessment:</b>	Homework/Projects	20-40%
	Quizzes/Tests	25-35%
	Final Exam	40-50%

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