MATH 576: Quantitative Risk Management (3 credits)

Instructor: Haijun Li
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Email: lih@math.wsu.edu
Office hours: Wed 1-4pm and by appointment

Prerequisite: Undergraduate calculus and linear algebra (equivalent to Math 201 and Math 202 at WSU); introductory-level university course on probability and statistics.

Textbooks:

Course Purpose:
This course provides an introduction to fundamental concepts in modern risk theory and mathematical/statistical methods in quantitative risk management. Concepts and methods covered in this course can be applied to managing risks in various areas, but we will proceed in the context related to risk analysis and management in finance and insurance.

Course Contents:
This course covers basic concepts in risk management, stylized facts of financial risky assets, coherent risk measures, stochastic models of risk factors, volatility modeling, risk estimation, multivariate analysis using copulas, risk aggregation and allocation, extreme value and tail risk analysis.

Week-to-Week Course Outline:
Week1: Loss distribution and risk factors
Week2: Stylized facts of risky assets and stochastic models of risk factors
Week3: Multivariate modeling and multivariate normal distribution
Week4: Normal mixture distributions
Week5: Copulas and basic properties
Week6: Dependence measures and tail dependence
Week7: Archimedean copulas
Week8: Fitting copulas to financial data
Week9: Coherent risk measures
Week10: Value-at-risk and tail conditional expectations
Week11: Risk aggregation and allocation
Week12: Generalized extreme value distributions
Week13: The Hill estimation for heavy tail index
Week14: Extreme value copulas and tail risk
Week15: Fitting a multivariate tail risk model
Week 16: Final Exam
Learning Outcomes:
Students will be able to (1) have a broader view on the relevant literature on risk analysis and management; (2) acquire state-of-the-art quantitative techniques for modeling risk factors and managing risk; (3) use MATLAB or R to get hands-on experience with real financial data.

Grade Breakdown:

- Pen-and-paper homework: 20%
- Midterm Exam: 30%
- Group projects (computational and data analysis projects): 20%
- Final exam: 30%

Total: 100%

Grade Distribution

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Attendance Policy: Students are expected to attend all the classes.

Academic Integrity:
Academic integrity will be strongly enforced in this course. Any student caught cheating on any assignment will be given an F grade for the course and will be reported to the Office Student Standards and Accountability. Cheating is defined in the Standards for Student Conduct WAC 504-26-010 (3). It is strongly suggested that you read and understand these definitions.

WSU Disability Statement:
Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center. For more information contact a Disability Specialist at Access.Center@wsu.edu or visit the webpage: http://accesscenter.wsu.edu

WSU Safety:
Washington State University is committed to enhancing the safety of the students, faculty, staff, and visitors. It is highly recommended that you review the Campus Safety Plan (http://safetyplan.wsu.edu/) and visit the Office of Emergency Management web site (http://oem.wsu.edu/) for a comprehensive listing of university policies, procedures, statistics, and information related to campus safety, emergency management, and the health and welfare of the campus community.