# Computational Financial Risk

**MATH 5xx, Fall 2019**

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INSTRUCTOR: Pete Benson (pbenson@umich.edu), 2082C East Hall

OFFICE HOURS: 10:00am-12:00pm Mondays, Wednesdays, or by appointment. Group appointments are encouraged.

WEB PAGE: See Canvas for all course details.

TEXTS: I will reference the following. Purchasing the texts is not essential.

- Allan M. Malz, *Financial Risk Management: Models, History, and Institutions*, 2010. Available online via https://search.lib.umich.edu.
- John C. Hull, *Risk Management And Financial Institutions*, 2015. Edition to be decided.
- Mina and Xiao, *Return to RiskMetrics: The Evolution of a Standard*, 2001. Available via download on Canvas.
- Yves Hipisch, *Python for Finance: Analyze Big Financial Data*.

GRADING:

- in class assignments (10%). Two lowest scores will be dropped.
- Homework problems (20%). You can discuss with others, but write and submit your own work.
- Python and Java programs (30%). You can work together on these. Grades will be based on brief one-on-one code in-class reviews with instructor.
- midterm exam (20%)
- final exam (20%)

PREREQUISITES: The equivalent of Math 423 (Mathematics of Finance), Math 425 (Introduction to Probability), a programming course (e.g. EECS 183)

SYNOPSIS: This course emphasizes understanding and implementing risk models using Python and Java, both of which have widespread use in finance. The style of the course is While the programming prerequisites are

minimal, during the course you should be prepared to develop fluency with the pandas and numpy libraries of Python, and object-oriented design in both languages. By the end, you will be well-prepared to interview for a quantitative role in risk management.

Expect to spend a portion of class time working in small groups. Everyone will be asked to on occasion to present their group's work to the class. This will give you practice in collaborating and communicating in financial language.

Course Outline

1. History of risk management and mismanagement
   (a) Regulatory environment, economic and regulatory capital
   (b) Investor environment
2. Object-oriented modeling of markets and portfolios
3. Modeling portfolio P&L
   (a) Variance-covariance (Markowitz)
   (b) Historical and Monte Carlo simulation
4. Risk Measures
   (a) Standard deviation, VaR, Expected shortfall
   (b) Risk attribution
   (c) Coherent risk measures
5. Credit Risk
   (a) CreditMetrics
   (b) Basket securities such as CDOs
6. Credit Valuation Adjustment (CVA)
7. Stress Testing

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