

IEOR E4602 Quantitative Risk Management: Spring 2010
Columbia University

Syllabus and Logistics

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Course Website: All course material will be posted on CourseWorks

Class Time: Tuesdays and Thursdays 10.35am to 11.50am.

Prerequisites Students should have taken the following courses or their equivalents:

1. IEOR E4701: Stochastic Processes for Financial Engineering
2. IEOR E4703: Monte Carlo Simulation

Students should also have some background in financial engineering so that they know, for example, what options, futures and the “Greeks” are. Students should also know some optimization (in particular linear programming) and financial data analysis. Courses like IEOR E4707: Optimization Models and Methods for Financial Engineering and IEOR E4709: Data Analysis for Financial Engineering are more than adequate for these purposes. You do not need to know any stochastic calculus for this course.

Textbooks There are no required textbooks for the class and there is no text that covers everything we will study in this course. The standard reference for this topic, however, is *Quantitative Risk Management* by McNeil, Frey and Embrechts and published by Princeton University Press.

Course Materials: Lecture slides, assignments and solutions to the assignments will be posted on CourseWorks. Students will also be directed to papers / primers that they will be asked to read before some of the lectures. These papers / primers are an integral part of the course. Lecture notes for some of the more detailed examples will also be posted on CourseWorks.

Assignments

There will be approximately 6 assignments that must be submitted on the due date. Late assignments will NOT be accepted. Students are welcome to work together on the assignments but each student MUST write up his or her own solution.

Exams

There will be a midterm and a final examination. The exams will *probably* be **closed-book**

where “cheat-sheets” will **not** be allowed. This will be confirmed at a later date. Any student who is unable to take an exam must have a very good reason, e.g. a medical emergency, for doing so. They will also require permission from the Dean’s Office if they therefore need to take a makeup exam. Any such makeup exam will be at least as difficult as the regular exam taken by the rest of the class.

Exam regrades may be requested by:

1. Explaining in a written statement why you think you should obtain more marks.
2. Submitting this statement and the exam to either the TA or course instructor no later than one week after the exam was returned to the class. (This means that if you failed to collect your exam within a week of it being returned to the class, then you cannot request a regrade!)

It should be kept in mind that when a regrade is requested the entire exam will be regraded and it is possible that your overall mark could go down as well as up. We will also photocopy a subset of the exams before returning them to the class. This is intended to deter the very few people (hopefully there are no such people in this class!) who might be tempted to rewrite parts of their exams before requesting a regrade.

Grading

The grading scheme will be *approximately*: Assignments 15%, Midterm 35%, Final 50%. But the instructor will reserve the right to deviate from this scheme as he sees fit.

Syllabus: Time permitting, the course will cover the following topics:

1. Basic concepts and techniques of risk management
2. Probabilistic models and stochastic processes for modeling financial data
3. Multivariate distributions including copulas, dimension reduction methods
4. Measures of risk including VaR, CVaR and coherent / incoherent risk measures
5. Extreme value theory
6. Insurance and operational risk
7. Monte-Carlo methods and importance sampling for loss estimation
8. Portfolio optimization with risk constraints

Several important topics that are not listed above include model risk, model ‘transparency’, and the risk of biases in financial data. They will be discussed by way of examples during the lectures and course assignments. Credit risk is a particularly important topic that we will not discuss formally. We will, however, introduce various credit models and examples during the course that will provide some exposure to this important topic.

There is clearly substantial overlap between these topics and some of the topics covered in the core FE courses in the Fall semester. This is to be expected given the interdisciplinary nature of risk management but this should be viewed as a strength rather than a weakness of the course: studying topics for a second time and in a different context should help reinforce and improve your understanding of this material.

Most of the assignments will require programming and while Matlab will be sufficient for some of the assignments, it may be necessary in the some parts of the course to write some VBA code. No prior knowledge of VBA is assumed but students should be prepared to learn some VBA during the course. SPlus / R will also prove useful as we may need to perform statistical data analysis and model calibration on occasion.