General course objectives:
The course gives an introduction to the programming language GAMS (General Algebraic Modelling Systems) using several examples from the practical domain of financial risk and portfolio management. Participants will work with problem areas which can be attacked using optimization models. They will learn to evaluate risk-return trade-offs, and to model, solve and document large, practical problems. GAMS will be used extensively in all the cases and examples.

The course is divided in two parts. The students may take part in one or both parts. Upon successful completion of the first week, the students may choose to stop. The students will earn 2.5 ECTS points with a pass/fail grade. This is the end of part one of the course. By completing this part of the course the students will have sufficient knowledge of GAMS to participate in the DTU course “Optimization in Finance: 42123” which is held on Tuesdays from 13-17 during the period September to early December.

In the second part of the course the students will be introduced to a number of more advanced optimization models in finance. At the end of the second week the students will be given a bigger project that they should finalize by 31th of August 2012. Upon successful completion of this project the students will earn 7.5 ECTS points and get a grade based on the Danish 7-step scaling system. This will be an alternative to taking the DTU course “Optimization in Finance: 42123”.

The students should inform, upon registration, whether they intend to participate in one or both parts of the course.

Learning objectives:
Participants who have followed the course will be able to formulate and solve optimization problems in GAMS in particular within the following areas:

- Measuring and managing return and risk trade offs
- Adding practical constraints to financial optimization problems
- Immunization and dedication of a bond portfolio
- Modelling Value at Risk and Conditional Value at Risk
- Back-testing results of an optimization problem ex-ante

Contents:

Week One:
Day 1
Introduction to GAMS using mean variance/ mean standard deviation optimization.

Day 2
Continued introduction to GAMS. Adding practical constraints such as fixed costs, size constraints and gearing to the mean variance model. Analysing the results in Excel.

Day 3
Continued introduction to GAMS. Introducing classical concepts in fixed income modelling and management: yield curve generation, portfolio dedication and immunization.

Day 4 and 5
Project work. The participants will be asked to formulate, solve and analyse a GAMS model based on a given problem formulation. The results should be presented at the end of week 1.

Week two

Day 1
Scenario generation and optimization. Case: index tracking and regret minimization.

Day 2
Scenario optimization continued. Case: Value at Risk and Conditional Value at Risk.

Day 3
Stochastic programming. Case: Mortgage loan refinancing.

Day 4
The final project will be introduced. We will work together on developing a back-testing framework for use in the final project.

Day 5
We will work on the final project in the class. By the end of this day the students should be able to perform independent work on the project until final delivery two weeks later.

Course literature: