Faculty of Science

MASM24, Mathematical Statistics: Valuation of Derivative Assets, 7.5 credits

Matematisk statistik: Prissättning av derivattillgångar, 7,5 högskolepoäng

Second Cycle / Avancerad nivå

Details of approval

The syllabus was approved by Study programmes board, Faculty of Science on 2007-01-31 and was last revised on 2007-01-31. The revised syllabus applies from 2007-07-01, autumn semester 2007.

General Information

The course is an elective course for second-cycle studies for a Master of Science in Mathematical statistics.

Language of instruction: Swedish and English

Main field of studies	*Depth of study relative to the degree requirements*
Mathematics	A1N, Second cycle, has only first-cycle course/s as entry requirements
Mathematical Statistics	A1N, Second cycle, has only first-cycle course/s as entry requirements

Learning outcomes

The aim of the course is that students on completion of the course should have acquired the following knowledge and skills:

Knowledge and understanding

On completion of the course, the students are expected to:

- understand the fundamental economical concepts : Financial contract/Contingent claim, Self financing portfolio, Arbitrage, Replicating portfolio/Hedge and Complete market,

- understand the tools and concepts from stochastic calculus: martingales, Itô's formula, Itô isometry, Feynman-Kac representation, change of measure (Girsanov transformation) and change of numeraire,
- understand how the basic financial contracts work and how they relate to each other, e.g., European and Asian options, Forward contracts, zero coupon bonds, coupon bond, LIBOR and interest rate swap.

Competence and skills

On completion of the course, the students are expected to:

- use the fundamental financial concepts to express relations between various financial contracts,
- use the tools and concepts from stochastic calculus to price financial contracts assuming specific models for the underlying assets. This especially includes the ability to use, derive and understand the Black-Scholes formula as well as the ability of extending it to similar contracts,
- use Monte Carlo methods to price financial derivatives. Here the student should be able to use various variance reduction techniques such as antithetic variables, control variates and importance sampling. This part of the course is assessed in the home assignments and compulsory computer exercises.

Judgement and approach

On completion of the course, the students are expected to:

- apply a mathematical point of view on financial contracts,
- from a financial and a mathematical perspective, judge what a reasonable valuation of a financial contract should fulfil.

Course content

The course consists of two related parts. In the first part we will look at option theory in discrete time. The purpose is to quickly introduce fundamental concepts of financial markets such as free of arbitrage and completeness as well as martingales and martingale measures. We will use tree structures to model time dynamics of stock prices and information flows.

In the second part we will study models formulated in continuous time. The models we focus on are formulated as stochastic differential equations (SDE:s). The theories behind Brownian motion, stochastic integrals, Ito-'s formula, measures changes and numeraires are presented and applied to option theory both for the stock and the interest rate markets. We derive e.g. the Black-Scholes formula and how to create a replicating portfolio for a derivative contract.

Course design

Teaching consists of lectures, home assignments, exercises, and computer exercises. Participation in computer exercises and thereby integrated teaching is compulsory.

Assessment

The examination is done by a written exam. Students who fail the regular exam are offered a re-examination shortly afterwards.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
For passing grade on the entire course passed home assignments written exam and participation in compulsory parts are required. The final grade is the grade on the written exam.

Entry requirements

For admission to the course knowledge equivalent to the courses MASA01, Mathematical Statistics: Basic Course, 15 credits and MASC03, Markov processes, 7.5 credits are required together with English B.

Subcourses in MASM24, Mathematical Statistics: Valuation of Derivative Assets

Applies from H15

0703 Laboratory Work part 1, 0,5 hp
Grading scale: Fail, Pass
0704 Laboratory Work part 2, 1,0 hp
Grading scale: Fail, Pass
0705 Exam, 6,0 hp
Grading scale: Fail, Pass, Pass with distinction

Applies from H11

1101 Exam, 6,0 hp
Grading scale: Fail, Pass, Pass with distinction
1102 Laboratory Work and Home Assignments, 1,5 hp
Grading scale: Fail, Pass