
VALUATION OF DERIVATIVE ASSETS, FMS170/MASM19
COURSE PROGRAMME VT-10

Home page

The course homepage is <http://www.maths.lth.se/matstat/kurser/fms170asm19>

Course expedition

Department Course secretary in room 127/128 i Math-building, southern part.
The expedition is open Mon-Fri 10¹⁵–11⁴⁵, 13³⁰–15⁴⁵, tele 046-222 45 77.

Course chief

Magnus Wiktorsson, room MH 130, tele 046-222 86 25, e-mail: magnusw@maths.lth.se

Computer exercise assistants

Magnus Wiktorsson
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Lectures and Exercises

Lecturer:

LP3(First half of semester): Magnus Wiktorsson
LP4(Second half of semester): Magnus Wiktorsson

Teaching assistant:

LP3: Magnus Wiktorsson, Stefán Ingi Adalbjörnsson
LP4: Magnus Wiktorsson, Stefán Ingi Adalbjörnsson

LP	Day	Time	Location
3	Wed	8–10	E:C (Lecture)
	Thu	13–15	E:3316,E:3319 (Exercise)
4	Tue	10–12	MA3 (Lecture)
	Fri	8–10	MH:229,MH:331 (Exercise)

Home assignments

The first home assignment is handed out at the first lecture. It should be handed in at the first computer exercise (or January 29 at 16 at the latest) It is then corrected. The errors should be corrected and the home assignment should be handed in again for correction.

The first home assignment is handed out at the first lecture in the second half of the semester. It should be handed in on January 29 at 16 at the latest. It is then corrected. The errors should be corrected and the home assignment should be handed in again for correction.

Computer exercises

The course has two compulsory computer exercises lasting 2 and 4 hours respectively. The computer exercises are in **room MH:230**.

Comp Exer 1 (Lp3: Tue January 26, at 18-20, Wed January 27, at 10-12 and Thu January 28, at 18-20 2 h., w2(5) The computer exercise deals with valuation of options in discrete time using Binomial trees. You will price both European and American type options. You will moreover study the convergence rate for Binomial trees.

Comp Exer 2 (Lp4: April 26, at 17-21, April 27, at 13-17 and April 28 at 17-21 4 h. w 5(17), prel.) Valuation of derivatives can be done through Monte Carlo simulations. This is the main theme in Computer Exercise 2. You will moreover apply various techniques to improve the simulations.

Note that there is an extra lecture about simulation related to the computer exercise the first week of the second half of the semester.

Literature

- T. Björk (2004) *Arbitrage Theory in Continuous Time*. Oxford University Press.
(Available as e-book for students with stil identities:
<http://www.oxfordscholarship.com.ludwig.lub.lu.se/oso/public/content/economicsfinance/9780199271269/toc.html>)
- S. Åberg (2010) *Derivative Pricing*. Mathematical Statistics, Lund.

The compendium *Derivative Pricing* contains material for some lectures, exercises and answers to the exercises. It is sold by the course secretary for 300 SEK.

Handed out papers All papers handed out on the lectures will be downloadable from the course homepage.

Examination

The exam is in the form of two home assignments and finally a written exam. To pass the course you need

- Correctly completed the two home assignments.
- Participated on both the compulsory computer exercises.
- Obtained a passing grade on the written exam. A passing grade is 3, 4 for 5 LTH students and G or VG for faculty of science students. Allowed aid: pocket calculator, pencil and rubber.

Exam

Ordinary exam: Tuesday **June 2** at 8–13 in MA10.

Re-exam: Tuesday **August 24** at 8–13 in MH362c(Prel).

Course content under first half of semester

The chapters are either in T. Björk's bok (**B**) or S. Åberg (former Rasmus) compendium (Å). **L** is for lectures, **E** is for teacher assisted exercises. An asterisk (*) after an exercise means that it should be done if you have time. The numbers after Week 1(3) means reading week and calendar week respectively.

Week 1(3)

First home assignment is handed out.

L1: Introduction, definition of different contracts, the economic model and concepts, discrete time models especially the Binomial model in one and multiple periods [Å 1, B 2].

E1: Å 1.(1–3), B 2.(1–3), Å 2.(1).

Week 2(4)

First home assignment should be handed in at Comp Exer1.

L2: Last part of discrete time models [B.2, 3, Å.2]. Probability theory. [Å 3 (see also B appendix B)]

E2: Å 2.(2–3) Å 3 (1,5,8,9)

Computer exercise 1: Binomial Model (26/1, at 18-20, 27/1, at 10-12 and 28/1 at 18-20).

Week 3(5)

L3: The Wiener Process [Å 4.1], The Ito-Integral and Ito's formula.[B 4. (1–5), Å 5.(1–2)].

E3: Å 4.(1,2,3,6,9), B 4.(1, 2, 4, 8), Å 4.11, Å 4.12 (Only I_1), Å 5.1-3.

Week 4(6)

L4: Filtering, Martingales [Å 4.2, B 4.4]. More Ito's formula and stochastic calculus [Å 5. (3,4), B 4. (5–8)].

E4: Å 4.(10,14,16,17), B 4.(5*, 6*) Å 5.(4–7).

Week 5(7)

L5: SDE:s Geometric Brownian motion, The Ornstein-Uhlenbeck process. The Feynman-Kac's formula. [B 5., Å 5.(3,5)]

E5: Å 5.(9,10,11), B 5.(5–12).

Week 6(8)

L6: Portfolio dynamics, Arbitrage-pricing (Classic) [B 6. och B 7.(1–4)].
E6: B 7.(1, 2, 4–7).

Week 7(9)

L7: B&S-formula [B 7.5]. Completeness [B 8.(1–3)] and hedging in the B&S model [B 8.(1–3), Å8].
E7: B 8.3, B 9.(2–4, 8–10).

Course contents under the second half of the semester (prel)**Week 1(11)**

Second home assignment is handed out.

L1: Complete, incomplete markets and the modern Arbitrage-pricing [Å 9. B 10, 15.]
E1: Å 6.5, Å 9.1–3,5–7.

Week 2(12)

L2: Change of Numeraires and its applications. [Å 9.2, B 24.1-5].
E2: Å 9. (8,9,11,12,14).

Easter break

Week 3(15)

L3: **Note Thu 13-15 MA3** Beyond the Black-Scholes model. [Å.7].
E3: **Extra lecture (Fri at 8-10 in MH:309A)** Simulation (a lecture related to computer exercise 2). [Å 13.].

Week 4(16)

L4: Introduction to Interest rate theory; Basic products and their arbitrage relations [Å 10, B 20].
E4: B 20.(2, 3, 5, 7), Å 10.(1,2,4).

Week 5(17)

Computer exercise 2. (Mon, Tue, & Wed) Simulation (26/4, at 17-21, 27/4 at 13-17 and 28/4, at 17-21).
Second home assignments should be handed in before the end of the week (Fri at. 16)
L5: Market models (LIBOR market models) [Å 11, B 25].
Ö5: B21.(1-4), Å 10.(6,8).

Week 6(18)

L6: Short rate models [B.21–22 Å 12.1-2].
E6: B 22.(1 (abc), 5, 6) B 23.(1–3, 5), Å 12.(1,2), Å 5.(14).

Week 7(19)

L7: Martingale models for the short rate and HJM models [B.22–23, Å 12.3].
E7: **Fri 8-10 (MH:309A)** Recapitulation lecture.

Exam

Ordinary exam: Tuesday **June 2** at 8–13 in MA10.
 Re-exam: Tuesday **August 24** at 8–13 in MH362c(Prel).