LUND UNIVERSITY INSTITUTE OF TECHNOLOGY
CENTRE FOR MATHEMATICAL SCIENCES
MATHEMATICAL STATISTICS

VALUATION OF DERIVATIVE ASSETS, FMSN25/MASTM24
COURSE PROGRAMME HT-19

Home page
The course homepage is [http://www.maths.lth.se/matstat/kurser/fmsn25masm24/](http://www.maths.lth.se/matstat/kurser/fmsn25masm24/)

Course expedition
Department Course secretary Susann Nordqvist in room 221 in Math-building, southern part.
The expedition is open Mon-Fri 8:00–11:00, 13:00–16:00, phone: 046-222 85 50, e-mail: susann.nordqvist@matstat.lu.se.

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

Computer exercises
Magnus Wiktorsson
Philip Kennerberg

Lectures and Exercises
Lecturer:
LP1 (First half of semester): Magnus Wiktorsson

Teaching assistant:
LP1: Philip Kennerberg

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Home assignment
The home assignment is handed out in reading reading week 4. It should be handed in on October 11 at 15 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 rooms E:Neptunus and E:Pluto.

**Comp Exer 1** (Reading week 2: Tue September 10, at 13-15, 2h.) 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** (Reading week 6: Tue October 8 at 13-17 4h.) 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 om simulation related to the computer exercise rw 5.
Literature


  See [http://www.maths.lth.se/matstat/kurser/fmsn25masm24/ht17/chtrans.html](http://www.maths.lth.se/matstat/kurser/fmsn25masm24/ht17/chtrans.html) for translation between the chapter numbers in 3rd and 2nd ed of Björk)


The compendium *Derivative Pricing* contains material for some lectures, exercises and answers to the exercises. It is sold at KF-sigma.

Handed out papers  All papers handed out on the lectures will be downloadable from the course home-page.

Examination

The exam is in the form of one home assignment and a written exam. To pass the course you need

- Correctly completed the home assignment.
- 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 eraser.

Exam

Ordinary exam: Friday **November 1, 2019** at 8–13 in VIC:3D.
Second Re-exam: Saturday **August 29, 2020** at 14–19 MA:10B.

Course content under first half of semester

The chapters are either in T. Björk’s bok (B) or S. Åberg (former Rasmus) compendium (Å) and Solved problems handout (P). 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(36)” means reading week and calendar week respectively.

Week 1(36)

  L1: Introduction, definition of different contracts, the economic model and concepts, discrete time models especially the Binomial model in one and multiple periods [Å 1.1.2, Å 2, B 2].
  E1: Å 2.(6–8), B 2.(1–3) (*Typo in B 2.1b $II(1;X) = X$ should be $II(1;X) \neq X$), Å 3.(1).
  L2: Last part of discrete time models [B.2, B.3, Å.3]. Probability theory. [Å 13 (see also B appendix B)]
  E2: Å 3.(2–3) Å 13 (5,6,7,11), P 1.5.1.

Week 2(37)

  E3: Å 4.(2,3,*,9), B 4,(1 (a-d)), Å 4.(10-12).
  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.(14,16,17), Å 5.(2,3(a),4,6,7),B 4.(7*), P 1.1.2.
Week 3 (38)

L5: SDEs: Geometric Brownian motion, The Ornstein-Uhlenbeck process. The Feynman-Kac’s formula. [B 5, Á 5(3,5)]

E5: Á 5(9,10,11), P(1.1.1), B 4(2,4,8), B 5(5–9).

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

E6: B 5.(10-12), B 7.(1, 2, 4–7), P (1.3.1).

Week 4 (39)

Home assignment is handed out.

L7: B&S-formula [B 7.5]. Completeness [B 8.(1–3)]

and hedging in the B&S model[B 8.(1–3),Á 8].

E7: B 8.3, B 9.(2–4, 8–10), P(1.4.1).

L8: Complete, incomplete markets and the modern Arbitrage-pricing [Á 9, 10.1, B 10.7, 15.]

E8: Á 6.4 (from course web page), Á 9.(1–3,10(2–4), P (1.5.2).

Week 5 (40)

L9: Change of Numerairs and its applications. [Á 10.2-4, B 26.1-5].

E9: Á 10. (5,6,8,9,11), P(1.6.1),(1.7.1).

L10: Simulation (a lecture related to computer exercise 2). [Á 11.].

L11: Extra lecture, Fri Oct 4 at 13-15 in MH:309A Beyond the Black-Scholes model. [(Á.7)].

Week 6 (41)

Home assignments should be handed in before the end of the week (Fri at 17)

Computer exercise 2. (Tue) Simulation (8/10 at 13–17).

L12: Introduction to Interest rate theory; Basic products and their arbitrage relations [ B 22., Á 1.4–1.5.3].

E10: B 22.(2, 3, 5, 7), Á 1.(3,6,9), P(1.6.2, 1.8.1).

L13: Market models (LIBOR market models) [B 27].

E11: B23.(1-4).

Week 7 (42)

L14: Short rate models [B.23–24].

E12: B 24.(1 (abc), 5, 6) B 25.(1, 2, 5), P 1.8.1.

L15: Martingale models for the short rate and HJM models [B.24–25].

E13: P 1.9.1,1.9.2 Recapitulation and questions.

Week 8 (43)


Exam

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Second Re-exam: Saturday August 29, 2020 at 14–19 MA:10B.