

Syllabus: Mathematical and Quantitative Finance 17017

Instructor: Agnieszka ^{*surname*} Jach (agnieszka.jach@hanken.fi)

Office hours: Thu 15:00-16:00h, D-wing, Room D612

Textbook: Main: J. Hull, *Options, Futures, and Other Derivatives*, Prentice Hall (9th edition available as an e-book via Hanken's library)

Others:

M. Joshi, *The Concepts and Practice of Mathematical Finance*, Cambridge, 2nd edition

P. Wilmott, *Introduces Quantitative Finance*, John Wiley and Sons, 2nd edition

Teaching materials: Detailed weekly study guidelines, theory slides, comp lab notes, instructions, links, etc are available on Moodle. Self-enrolment key for Moodle: please, check 'Messages' in SISU.

Week	Dates (Mon-Fri)	Assignment due Wed 18h	Class Thu 16-19:15h	Assignment due Fri 18h
4	20-24.01		Intro/Lab0, Ch1.WienerItoPart1	
5	27-31.01	PracticeQuiz0 (optional)	Lab1, Ch1.WienerItoPart2	TheoryQuizCh1
6	03-07.02		'Black-Board' , Ch2.BlackScholesPart1	
7	10-14.02	PracticeQuiz1	Ch2.BlackScholesPart2, Lab2	TheoryQuizCh2
8	17-21.02	PracticeQuiz2	Ch3.Options, Lab3 (Study Chapter 4 yourself)	TheoryQuizCh3
9	24-28.02		Ch5.InterestRatesPart1, Lab5a	
10	03-07.03	PracticeQuiz3	Ch5.InterestRatesPart2, Lab5b	TheoryQuizCh5
11	10-14.03		NA, P3-P4 break, no class	
12	17-21.03	PracticeQuiz4	Guest Lecturer Ch6.CreditRiskPart1, Lab6a	
13	24-28.03		Ch6.CreditRiskPart2, Lab6b	TheoryQuizCh6
14	31.03-04.04	PracticeQuiz5	Ch7.VolCorr, Lab7	TheoryQuizCh7
15	07-11.04		Ch8.ValueAtRisk, Lab8	TheoryQuizCh8
16	14-18.04	PracticeQuiz6	NA, Easter Holidays 17-23.04 Thu-Wed	
17	21-25.04		Ch9.ModernToolsPart1, Lab9a	
18	28.04-02.05		Monday! Ch9.ModernToolsPart2, Lab9b	TheoryQuizCh9
19	05-09.05	PracticeQuiz7	NA	NA

Table 1: Detailed class schedule, Ch=Chapter (see page 3 for details).

Schedule: 13 double-slot sessions (each 3h) that combine theory and practice in the computer lab A407 (bring your laptop if you can):

- theory part (you study the theory slides before the session and then, during the theory part, solve a 'theory' quiz with the teacher and other students);
this is so-called flipped classroom
- practice part (related computer lab/black-board)

See Table 1 for details.

Databases: Please, make sure that, before the course starts, you have remote access (as a Hanken user) to WRDS <https://wrds-www.wharton.upenn.edu/> and you have a Bloomberg account (in Quantum)

Free software: R (computations and graphics) is used within its IDE `rstudio` (IDE=integrated development environment); RMarkdown (generation of documents with text and code) - embedded in `rstudio`. Please install it on your personal computer before the first class.

Marks: 30pts (final exam quiz) + 70pts (theory and practice quizzes)

IMPORTANT: At least 35% of the exam score (35%=10.5/30pts), at least 50% score from the 'theory' quizzes, at least 50% score from the 'practice' quizzes are needed to be considered for passing the course (eg, if a person scores 70pts on the non-exam work, but fails to get at least 10.5/30pts on the final, then their semester mark is 'fail'; likewise, if a person doesn't reach the minimum score on the 'practice' quizzes, then they are not eligible to take the 'final exam').

Final exam, 30pts: individual, open-book in form of a Moodle quiz which requires coding (code submission will be used for plagiarism check and possibly other checks; it will not be marked). Questions are similar to the theory and practice quizzes. You do the exam on your personal computer from wherever you want (eg, from home). **Dates: 12.05.2025 (first attempt), 07.06.2025 (second attempt), 14:00-16:00h on both occasions.**

Theory and practice quizzes, 70pts: individual

- eight 'theory' Moodle quizzes each for 1-5pts (almost entirely solved in class);
- seven 'practice' Moodle quizzes each for 5-10pts, mainly coding-based
Code will be used for plagiarism check and possibly other checks; it will not be marked; lack of code submission in the indicated manner will invalidate quiz submission; code submission with a similarity score exceeding 80% will lead to the same outcome.
See Moodle for tips to avoid high similarity scores.
- Deadlines: see Table 1.
- Late submissions are **not allowed/accepted**.
- HW- and material-related questions can be posted on the specially designed Moodle forum and **ideally should not be consulted via e-mail**.

Bonus credit: 5pts, 'practice' Quiz0 (code submission as on the other 'practice' quizzes, see above)

Contents: (names = chapters' names in Hull, the main textbook)

1. Wiener Process and Itô's Lemma
2. The Black-Scholes-Merton Model
3. Options on stock indices, currencies, and futures
4. Martingales and measures
5. Interest rate derivatives: models of the short rate and HJM
6. Credit risk
7. Estimating volatilities and correlations
8. Value at risk

and two additional topics/chapters

0. 'Preliminaries' (some basic elements such as random variables, numerical/graphical summaries of the distributions, central limit theorem, bootstrap; some more advanced elements for the curious readers, hence the quotes around Preliminaries)
9. Modern computational tools in finance (wavelets, VPIN [volume probability of informed trading], SOM [self-organizing map]). Functional Data Analysis will be introduced in Chapter 5.