Syllabus:
Mathematical and Quantitative Finance 17017

Instructor: Agnieszka $\overbrace{\text{Jach}}^{surname}$ (agnieszka.jach@hanken.fi)

Office hours: Wed 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 **Tue 23:59h**	Class **Wed 16-19:15h**	Assignment due **Fri 23:59h**
4	19-23.01		Intro/Lab0, Ch1.WienerItoPart1	
5	26-30.01	PracticeQuiz0 (optional)	Lab1, Ch1.WienerItoPart2	TheoryQuizCh1
6	02-06.02	PracticeQuiz1	'Black-Board' , Ch2.BlackScholesPart1	
7	09-13.02		Ch2.BlackScholesPart2, Lab2	TheoryQuizCh2
8	16-20.02	PracticeQuiz2	Ch3.Options, Lab3	TheoryQuizCh3
9	23-27.02		Ch4.InterestRatesPart1, Lab4a	
10	02-06.03	PracticeQuiz3	Ch4.InterestRatesPart2, Lab4b	TheoryQuizCh4
11	09-13.03		NA, P3-P4 break, no class	
12	16-20.03	PracticeQuiz4	Ch5.CreditRiskPart1, Lab5a Guest Lecturer	
13	23-27.03		Ch5.CreditRiskPart2, Lab5b	TheoryQuizCh5
14	30.03-03.04	PracticeQuiz5	Ch6.VolCorr, Lab6	TheoryQuizCh6
15	06-10.04		NA, Easter Holidays 02-08.04 Thu-Wed	
16	13-17.04		Ch7.ValueAtRisk, Lab7	TheoryQuizCh7
17	20-24.04	PracticeQuiz6	Ch8.ModernToolsPart1, Lab8a	
18	27.04-01.05		Ch8.ModernToolsPart2, Lab8b	TheoryQuizCh8
19	04-08.05	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 a classroom, A309 (bring your laptop to every session):

- 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.

Use of AI: exam-quiz and hw-quizzes: red light. Everything else: green light.

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').

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 not be marked but it will be used for various checks such as similarity, AI, etc; you have to annotate your code accordingly so that your code submission gets approved; submission that fails the approval criteria or lack of submission in the indicated manner will invalidate code and quiz submissions.
  See Moodle for more.
- 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)

Final exam, 30pts: individual, open-book in form of a Moodle quiz which requires coding (code-submission rules will be described on Moodle). 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: 11.05.2026 (first attempt), 06.06.2026 (second attempt), 14:00-16:00h on both occasions.

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. Interest rate derivatives: models of the short rate and HJM
5. Credit risk
6. Estimating volatilities and correlations
7. 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)

8. Modern computational tools in finance (wavelets, VPIN [volume probability of informed trading], SOM [self-organizing map]). Functional Data Analysis will be introduced in Chapter 4.