Academic Year 2023/2024, P3-P4, Mathematical and Quantitative Finance 17017

Syllabus:
Mathematical and Quantitative Finance 17017

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

Office hours: Tue 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)	Tue 16-19:15h	Assignment deadline	
			Wednesday 18h	Friday 18h
4	22-26.01	Intro/Lab0, Ch1.WienerItoPart1		Quiz0 due (optional)
5	29.01-02.02	Lab1, Ch1.WienerItoPart2	TheoryQuizCh1	
6	05-09.02	Black-Board, Ch2.BlackScholesPart1		PracticeQuiz1
7	12-16.02	Ch2.BlackScholesPart2, Lab2	TheoryQuizCh2	PracticeQuiz2
8	19-23.02	Ch3.Options, Lab3 (Study Chapter 4 yourself)	TheoryQuizCh3	
9	26.02-01.03	Ch5.InterestRatesPart1, Lab5a		PracticeQuiz3
10	04-08.03	Ch5.InterestRatesPart2, Lab5b	TheoryQuizCh5	
11	11-15.03	NA P3-P4 break, no class		
12	18-22.03	Guest Lecturer Ch6.CreditRiskPart1, Lab6a		PracticeQuiz4
13	25-29.03	Ch6.CreditRiskPart2, Lab6b	TheoryQuizCh6	
14	01-05.04	NA, Easter Holidays 28.3-3.4, no class		PracticeQuiz5
15	08-12.04	Ch7.VolCorr, Lab7	TheoryQuizCh7	
16	15-19.04	Ch8.ValueAtRisk, Lab8	TheoryQuizCh8	PracticeQuiz6
17	22-26.04	Ch9.ModernToolsPart1, Lab9a		
18	29.04-03.05	Ch9.ModernToolsPart2, Lab9b	TheoryQuizCh9	PracticeQuiz7

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').

   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: 13.05.2024 (first attempt), 08.06.2024 (second attempt), 14-16h 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)

- 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

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.