



## Course and Examination Fact Sheet: Autumn Semester 2017

### 9,151: Computational Finance

ECTS credits: 4

#### Overview examination/s

(binding regulations see below)

Decentral - Oral examination (individual) (75%, 15 mins.)

Decentral - Group examination paper (all given the same grades) (25%)

#### Attached courses

Timetable -- Language -- Lecturer

[9,151,1.00 Computational Finance](#) -- Englisch -- [Schürle Michael](#)

#### Course information

#### Course prerequisites

Participation in course "Quantitative Methods" (7,160) is helpful.

The course is recommended for MBF-students in their third semester of the program.

#### Course content

The valuation of financial derivatives cannot always be performed by closed-form solutions to the underlying pricing equations. In particular more complex options require the application of advanced numerical methods. This course provides a solid introduction to financial option valuation and the numerical techniques applied by quantitative analysts to price single- and multiasset options without and with early exercise rights, barriers and other exotic features. Calibration methods are also discussed.

Examples for the implementation of the individual concepts are presented in MATLAB, a tool which has become standard in the banking industry. A prior background in numerical analysis or MATLAB is not required, but students are expected to become familiar with the language and solve programming exercises in the self-study part. The solution of a complex valuation problem is compulsory and part of the examination.

#### Course structure

- Option valuation preliminaries, principle of risk neutral valuation
- Binomial model and extension to American options



- Black-Scholes PDE
- Greeks and hedging
- Derivation of the implied volatility
- Exotic options
- Random number generation
- Monte Carlo methods and variance reduction
- Simulation of stochastic processes (stochastic differential equations)
- Quasi-Monte Carlo methods
- Finite difference methods

## Course literature

- Lecture notes will be provided on Studynet
- D. J. Higham: An Introduction to Financial Option Valuation
- J. Hull: Options, Futures, and Other Derivatives
- R. Seydel: Tools for Computational Finance

## Additional course information

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## Examination information

### Examination sub part/s

#### 1. Examination sub part (1/2)

##### Examination time and form

Decentral - Oral examination (individual) (75%, 15 mins.)

##### Remark

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##### Examination-aid rule

Extended Closed Book

The use of aids is limited; any additional aids permitted are exhaustively listed under "Supplementary aids". Basically, the following is applicable:

- At such examinations, all the pocket calculators of the Texas Instruments TI-30 series and mono- or bilingual dictionaries (no subject-specific dictionaries) without hand-written notes are admissible. Any other pocket calculator models and any electronic dictionaries are inadmissible.
- In addition, any type of communication, as well as any electronic devices that can be programmed and are capable of communication such as notebooks, tablets, PDAs, mobile telephones and others, are inadmissible.
- Students are themselves responsible for the procurement of examination aids.



## Supplementary aids

no auxiliary means admitted

## Examination languages

Question language: English

Answer language: English

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## 2. Examination sub part (2/2)

### Examination time and form

Decentral - Group examination paper (all given the same grades) (25%)

### Remark

programming exercise & documentation (group work)

### Examination-aid rule

Term papers

- Term papers must be written without anyone else's help and in accordance with the known quotation standards, and they must contain a declaration of authorship.
- The documentation of sources (quotations, bibliography) has to be done throughout and consistently in accordance with the APA or MLA standards. The indications of the sources of information taken over verbatim or in paraphrase (quotations) must be integrated into the text in accordance with the precepts of the applicable quotation standard, while informative and bibliographical notes must be added as footnotes (recommendations and standards can be found, for example, in METZGER, C. (2015), Lern- und Arbeitsstrategien (11th ed., 4th printing). Aarau: Sauerländer).
- For any work written at the HSG, the indication of the page numbers both according to the MLA and the APA standard is never optional.
- Where there are no page numbers in sources, precise references must be provided in a different way: titles of chapters or sections, section numbers, acts, scenes, verses, etc.
- For papers in law, the legal standard is recommended (by way of example, cf. FORSTMOSER, P., OGOREK R. et SCHINDLER B. (2014, Juristisches Arbeiten: Eine Anleitung für Studierende (5. Auflage), Zürich: Schulthess, or the recommendations of the Law School).

## Supplementary aids

none

## Examination languages

Question language: English

Answer language: English

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## Examination content

Overview (an extensive check list will be provided on StudyNet before the exam):

- Option valuation preliminaries, principle of risk neutral valuation
- Binomial model and extension to American options
- Black-Scholes PDE
- Greeks and hedging
- Derivation of the implied volatility
- Exotic options
- Random number generation
- Monte Carlo methods and variance reduction
- Simulation of stochastic processes (stochastic differential equations)
- Quasi-Monte Carlo methods
- Finite difference methods



## Examination relevant literature

Lecture notes, self-study exercises and other material assigned during the lectures

### Please note

We would like to point out to you that this fact sheet has absolute priority over other information such as StudyNet, faculty members' personal databases, information provided in lectures, etc.

When will the fact sheets become binding?

- Information about courses and examination time (central/decentral and grading form): from the start of the bidding process on 24 August 2017
- Information about decentral examinations (examination-aid rule, examination content, examination relevant literature): after the 4th semester week on 16 October 2017
- Information about central examinations (examination-aid rule, examination content, examination relevant literature): from the start of the enrolment period for the examinations on 06 November 2017

Please look at the fact sheet once more after these deadlines have expired.