University of St.Gallen

Course and Examination Fact Sheet: Spring Semester 2022

8,116: Stochastic Modeling in Finance and Insurance

ECTS credits: 6

Overview examination/s

(binding regulations see below)
Decentral - examination paper written at home (individual) (50%)
Examination time: term time
Decentral - Written examination (with defined exam duration) (50%, 90 mins.)
Examination time: term time

Attached courses

Timetable -- Language -- Lecturer
8,116,1.00 Stochastic Modeling in Finance and Insurance -- Englisch -- Braun Alexander

Course information

Course prerequisites

Basic knowledge in finance and statistics.

Learning objectives

Upon leaving this course, participants will be able to:

- Implement various categories of financial models in R
- Run Monte-Carlo Simulations in R
- Harness R's powerful graphical capabilities
- Tailor own models for specific issues in finance and insurance

Course content

The course teaches students fundamental concepts in stochastic modeling. It keeps the mathematical depth (derivations and proofs) at a moderate level in order to make room for concrete applications, examples, and exercises.While formal representations of key models and statistical concepts will be revisited, the focus lies on the students' ability to implement these in R. In other words, the didactical emphasis is on skills ("doing") instead of knowledge.On the technical side, the course relies on R, a powerful free programming language/environment for statistical computing.

The skills taught in this course are particularly useful for students who want to pursue a professional career in areas such as securities trading, derivatives, asset-liability management, risk management, underwriting and many more. The industry focus is on financial intermediaries such as banks, re/insurance companies, asset managers and pension funds.

Course structure and indications of the learning and teaching design

The course content is distributed across three didactic pillars:

- Interactive lectures - introduction and discussion of the models
- Exercise sessions - experimentation with the code
- Problem sets - deep dive in applications

The lectures and exercise sessions will be held in a physical format during the first half of the semester. Each of these two components represents one 90-minute session per week (180 minutes in total). After the break, there will be one more physical session (90-180 minutes) for the wrap up of the material and Q&A. Subsequently students will solve a total of five weekly

problem sets at home. Each problem set requires a time investment of 180 minutes and counts towards the overall course grade (50% in total). The final exam takes the form of an online mini hackathon (90 minutes, 50% of the course grade) and will be held in the last week of the semester.

Tentative course structure:

1) Probability Theory and Introduction to R

- Random Variables, Distributions, Stochastic Processes
- Monte Carlo Simulations
- R Data Types, Syntax, Objects, Operations
- R Graphical Capabilities

2) Portfolio Modeling

- Risk Measures
- Markowitz Optimization
- Asset-Liability Modeling

3) Equity Risk

- Geometric Brownian Motion
- Jump-Diffusion Processes
- Equity Derivatives

4) Interest Rate Risk

- Term Structure Models
- Vasicek Model
- Interest Rate Derivatives

5) Credit Risk

- Structural Models
- Reduced-Form Models
- Credit Derivatives

6) Insurance Risk

- Modeling Insurance Claims
- Collective Risk Model
- Lee-Carter Model

Course literature

- Lecture Notes
- Additional literature will be assigned in class

Additional course information

Note on COVID-19: Due to the ongoing COVID-19 pandemic it cannot be ruled out that the lecture needs to be delivered online only via Zoom. In this case, lectures will also be recorded and provided to students on CANVAS. The written examination will also be conducted online.

Examination information

University of St.Gallen

Examination sub part/s

1. Examination sub part (1/2)

Examination time and form
Decentral - examination paper written at home (individual) (50%)
Examination time: term time

Remark
Problem Sets 1-5 (10% each)

Examination-aid rule
Term papers

Written work must be written without outside help according to the known citation standards, and a declaration of authorship must be attached, which is available as a template on the StudentWeb.

Documentation (quotations, bibliography, etc.) must be carried out universally and consistently according to the requirements of the chosen/specified citation standard such as e.g. APA or MLA.

The legal standard is recommended for legal work (cf. by way of example: FORSTMOSER, P., OGOREK R., SCHINDLER B., Juristisches Arbeiten: Eine Anleitung für Studierende (the latest edition in each case), or according to the recommendations of the Law School).

The reference sources of information (paraphrases, quotations, etc.) that has been taken over literally or in the sense of the original text must be integrated into the text in accordance with the requirements of the citation standard used. Informative and bibliographical notes must be included as footnotes (recommendations and standards e.g. in METZGER, C., Lern- und Arbeitsstrategien (latest edition)).

For all written work at the University of St.Gallen, the indication of page numbers is mandatory, regardless of the standard chosen. Where page numbers are missing in sources, the precise designation must be made differently: chapter or section title, section number, article, etc.

Supplementary aids
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Examination languages
Question language: English
Answer language: English

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2. Examination sub part (2/2)

Examination time and form
Decentral - Written examination (with defined exam duration) (50%, 90 mins.)
Examination time: term time

Remark
The final exam will be a mini hackathon (online)

Examination-aid rule
Online remote examination - Open book

Students are free to choose aids but will have to comply with the following restrictions:

- Calculator models which do not belong to the Texas Instruments TI-30 series are explicitly not allowed.
- In addition, any type of communication is inadmissible, as are all electronic devices that can be programmed and enable communication, such as electronical dictionaries, additional notebooks, tablets, mobile phones and other devices, which have not been explicitly permitted by the faculty member in charge.

The procurement of the electronic aids as well as ensuring their functionality and fulfillment of the technical requirements is the

responsibility of the students.

The examination must be carried out using the programs defined in advance by the faculty member in charge. Mastery of the operation of the programs is part of the examination.

Supplementary aids
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Examination languages
Question language: English
Answer language: English

Examination content

All course contents/topics as defined in detail above, as long as they are treated in class.

Examination relevant literature
Lecture notes.

Please note

Please note that only this fact sheet and the examination schedule published at the time of bidding are is binding and takes precedence over other information, such as information on StudyNet (Canvas), on lecturers' websites and information in lectures etc.

Any references and links to third-party content within the fact sheet are only of a supplementary, informative nature and lie outside the area of responsibility of the University of St.Gallen.

Documents and materials are only relevant for central examinations if they are available by the end of the lecture period (CW21) at the latest. In the case of centrally organised mid-term examinations, the documents and materials up to CW 12 are relevant for testing.

Binding nature of the fact sheets:

- Course information as well as examination date (organised centrally/decentrally) and form of examination: from bidding start in CW 04 (Thursday, 27 January 2022);
- Examination information (regulations on aids, examination contents, examination literature) for decentralised examinations: in CW 12 (Monday, 21 March 2022);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 12 (Monday, 21 March 2022);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: two weeks before the end of the registration period in CW 15 (Monday, 11 April 2022).