



Course and Examination Fact Sheet: Spring Semester 2022

8,275: Functional Programming with Applications

ECTS credits: 4

Overview examination/s

(binding regulations see below)

Decentral - examination paper written at home (individual) (50%)

Examination time: term time

Decentral - examination paper written at home (individual) (50%)

Examination time: term time

Attached courses

Timetable -- Language -- Lecturer

[8,275,1.00 Functional Programming with Applications](#) -- Englisch -- [Zahn Philipp](#)

Course information

Course prerequisites

Previous experience with general purpose programming languages is helpful but not mandatory as we build the course from first principles.

Learning objectives

- Basic understanding key elements of functional programming
- Ability to implement a small programming project

Course content

This course provides an introduction into functional programming. Most economists, as far as they are trained in programming, use to think about programming in an imperative, i.e. procedural, way. Functional programming provides us with a fresh and alternative view on what programs and processes are. Besides learning the necessary basics, this course aims to give such a new perspective. Depending on the application, programming in a functional style is actually more natural to the way we as economists use to think in terms of theory. We will illustrate this by considering three applications, one in probabilistic modelling, one in smart contract design, and one in auction design. Functional programming has also become an important tool in industry applications. Part of its appeal is the ability to provide high-level abstractions as well as high-quality (less buggy) code. The latter, for instance, is needed in blockchain applications.

Tentative syllabus:

1. Principles of functional programming: expressions, evaluations, functions, and types.
2. Type definitions and built-in types: numbers, characters, strings and lists. Basic operations on lists, including map, fold and filter, together with their algebraic properties.
3. Recursive definitions and structural induction. Infinite lists and their uses.
4. Further data structures: binary and general trees.
5. Application Smart contracts: Composing contracts
6. Application Probabilistic Programming: Automatic inference for probabilistic models
7. Application Auction Design: Robust design of complex auctions
8. (Optional if time permits: Automating theory - the open games engine)



Course structure and indications of the learning and teaching design

We will have weekly pre-recorded lectures and weekly live discussion sessions. The course will take place online for the whole semester. Depending on demand for the course and on availability we will also have guest lecturers from industry discussing the role of functional programming in their domain, what value you, as economists, can bring to the table, and what skills you need to master.

Course literature

The course will not follow one textbook but rely on different sources that will be provided along the way. This also includes papers when we discuss applications.

Additional course information

In the case of the President's Board having to implement new directives due to the SARS-CoV-2 pandemic in SpS2022, the course information listed above will be changed as follows:

There are no changes necessary to the course information.

The examination information listed below would be changed as follows:

- There are no changes necessary to the examination information.

Examination information

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

Take home exam

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

2. Examination sub part (2/2)

Examination time and form

Decentral - examination paper written at home (individual) (50%)

Examination time: term time

Remark

2 individual problem sets

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.

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Supplementary aids

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Examination languages

Question language: English

Answer language: English

Examination content

The take home exam as well as the problem-sets will deal the following topics:

- Principles of functional programming: expressions, evaluations, functions, and types.
- Type definitions and built-in types: numbers, characters, strings and lists. Basic operations on lists, including map, fold and filter, together with their algebraic properties.
- Recursive definitions and structural induction. Infinite lists and their uses.
- Further data structures: binary and general trees.
- Application Smart contracts: Composing contracts
- Application Probabilistic Programming: Automatic inference for probabilistic models
- Application Auction Design: Robust design of complex auctions
- Automating theory - the open games engine

Examination relevant literature



Lecture slides, references reading material, and papers discussed in the context of the applications

Please note

Please note that only this fact sheet and the examination schedule published at the time of bidding are 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).