Fortgeschrittene funktionale Programmierung
LVA 185.A05, VU 2.0, ECTS 3.0
SS 2019
– Vorbesprechung –
(Stand: 07.03.2019)

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Information Systems Engineering
Compilers and Languages
Topics and Objectives

...advanced principles of functional programming, applications, implementation issues of functional programming languages.

▶ Functional data structures and algorithms, functional pearls
▶ Programming with streams, combinators, monads, arrows
▶ Testing, verification, correctness by construction
  ▶ Automatic testing, automatic test case generation
  ▶ Induction, coinduction, equational reasoning
▶ Combinator libraries, embedded domain-specific languages
▶ Parallelism in functional languages
▶ Applications
  ▶ Monadic parsing, combinator parsing, pretty printing
  ▶ Functional logic programming
  ▶ Functional reactive systems
  ▶ ...
▶ ...
▶ ...
Outline

- **Part I: Motivation**
  - Why functional programming matters.

- **Part II: Programming Principles**
  - Programming with streams, higher-order functions, algorithm patterns, equational reasoning, memoization.

- **Part III: Quality Assurance**
  - Automatic testing, verification, correctness by construction.

- **Part IV: Advanced Language Concepts**
  - Functional arrays, abstract data types, monoids, functors, monads, arrows.

- **Part V: Applications**
  - Parsing, logical programming functionally, pretty printing, functional reactive programming.

- **Part VI: Extensions, Perspectives**
  - Parallelism, ‘real world’ programming.
Goals

► Overview, insight, and profound understanding of advanced principles of functional programming and their application in practice.

► Profound understanding of the foundations of functional programming.

► Insight in advantages and limitations of a purely functional style of programming.
Accounts for

- Elective course (Wahlfach) for the Master program 066 937 Software Engineering & Internet Computing (3.0 ECTS)
- Elective course (Wahlfach) for the Master program 066 931 Computational Intelligence (3.0 ECTS)
- Elective course (Wahlfach) for the Master program 066 950 Informatikdidaktik (3.0 ECTS)
- Examination course (Prüfungsfach) for the Erasmus-Mundus Master program 066 011 DDP Computational Logic (Erasmus-Mundus) (3.0 ECTS)
Prerequisites

- Completed Bachelor program
- Basic knowledge of the **functional programming style** as imparted e.g. in the course **LVA 185.A03 Funktionale Programmierung**, VU 2.0, ECTS 3.0
Overall Organization

- Lectures
  - Usually once a week, block-style; first course meeting on March 7, 2019.

- (Programming) assignments
  - Usually weekly, to be worked on and solved by teams of (typically) 2 students.

- Final oral examination
  - About course material and assignments.
Overall Organization in more Detail

Lectures

 ► Block style: Usually every Thursday, 4.15pm to 5.45pm, Seminarraum Argentinierstr. EAEG06, ground floor of the ‘Institutsgebäude EA’; Argentinierstr. 8.

Assignments

 ► Issued: Usually every Wednesday, about 8 assignments in total, starting on March 20, 2019.
 ► Submission, 1st round: Automatically collected and checked one week after issuing at 3.00pm in the afternoon, must be stored in the home directory of your group account.
 ► Submission, 2nd round, after bug fixing: One week later, if the 1st round results are available on Monday, 9.00am, otherwise another week later.

Course Material

 ► Lecture slides, assignments, available on the homepage of the course.
Assessment, Grades

Grade on Programming Assignments

- Points per assignment: max. 100.
- Point achieved per assignment: Half of the sum of the points of the 1st and 2nd submission round.
- Minimum requirement for a positive grade: $\geq 50\%$ of the max. number of points achievable.

Final Grade

- Based on grades for the programming assignments and the final oral examination.
- Positive overall grade only, if both parts are positive.
Registration, Accounts, Passwords

Registration

- Via TISS on or before March 15, 2019, in teams of 2 students (in exceptional cases of 1 or 3 students)
- **Cancelling a registration:** Via TISS on or before March 31, 2019.

Accounts

- Each team of students receives an account for the machine `g0.complang.tuwien.ac.at`
- Account information and initial password are sent to every team member via email to the generic standard address `e<Matr.Nr>@student.tuwien.ac.at`

For further information

- Visit the homepage of the course: `www.complang.tuwien.ac.at/knoop/ffp185A05_ss2019.html`
Usage of Computers, Working at Lab/at Home

- **Server:** g0.complang.tuwien.ac.at
- **Lab and terminals for course usage:** Institutsgebäude EA, Argentinierstr. 8, ground floor
- **Usage of other computers:** is encouraged (e.g., at home)
- **Required software:** Hugs (available free of charge)
- **Solutions of assignments:** must be up-loaded to the server g0.complang.tuwien.ac.at
Recommended Reading: Basics


6. ...
Recommended Reading: Advanced


7. ...
Further Reading, Web Resources

Further Reading Recommendations

- Specific reading recommendations are provided for every chapter on-the-fly of the course.

Web Resources

- Haskell Homepage:  www.haskell.org/
- Haskell Tutorial:  www.haskell.org/tutorial/
- Hugs Interpreter:  www.haskell.org/hugs
Team, Course Homepage

Team

- Jens Knoop
- Ulrich Neumerkel

Course homepage

http://www.complang.tuwien.ac.at/knoop/ffp185A05_ss2019.html
Perfect Add-Ons this Term (1)

► o.Univ.Prof.(em.) Dr. Andreas Frank
Institut für Geoinformation und Kartographie

LVA 127.008 VU 2.0, ECTS 3.0
Haskell-Praxis: Programmieren mit der Funktionalen
Programmiersprache Haskell
Tue, 3.00 pm to 4.30 pm
Seminar room 127, 3rd floor, Gußhausstr. 25-29.
(The course will be held in English.)

...double-check, if this course will be held this term!
Perfect Add-Ons this Term (2)

▶ ao.Prof. Dr. Thomas Grechenig
Institut für Information Systems Engineering

LVA 183.653 VU 2.0, ECTS 3.0
Methodisches, industrielles Software-Engineering mit funktionalen Sprachen am Fallbeispiel von Haskell
Mon, 5.30 pm to 7.00 pm

...double-check, if this course will be held this term!
Interested in Studying Abroad?

The Erasmus Programme of the European Union offers a plenty of exciting opportunities, e.g.

- Linköping University, Sweden
- Aalto University, Finland
- The University of Copenhagen, Denmark
- Universität Halle-Wittenberg, Germany
- Universität Paderborn, Germany
- Universidad Politècnica de València, Spain
- ...

For further information, please, visit: http://www.complang.tuwien.ac.at/knoop/erasmus
Ich wünsche Ihnen

...viel Erfolg bei dieser Lehrveranstaltung und dass Sie auch über die unmittelbare Veranstaltung hinaus davon profitieren!

Nicht zuletzt:
Vorlesung und Übung leben mit Ihnen! Ihre Rückmeldungen, Anregungen, Verbesserungsvorschläge sind willkommen!
Natürlich auch Hinweise, wenn Ihnen etwas gut gefallen hat!