Fortgeschrittene funktionale Programmierung

LVA 185.A05, VU 2.0, ECTS 3.0
SS 2012

Jens Knoop

Technische Universität Wien
Institut für Computersprachen

Course Objectives

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

- Functional data structures and algorithms
- Combinator libraries and embedded domain-specific languages
- Programming with streams, programming with monads
- Monomorphic and polymorphic type checking
- Parsing (monadic parsing vs. combinator parsing)
- Functional vs. logical programming
- Parallelism in functional languages
- Graphical user interfaces
- ...

Goals

- Overview of advanced concepts 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

Creditable for

- As elective course (Wahlfach) within the Master program 066 937 “Software Engineering/Internet Computing” (3.0 ECTS)
- As elective course (Wahlfach) within the Master program 066 931 “Computational Intelligence” (3.0 ECTS)
- As elective course (Wahlfach) within the Master program 066 950 “Informatikdidaktik” (3.0 ECTS)
- As examination course (Prüfungsfach) towards 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*)

Course Organization

...depending on the number of participants.

- Lecture
- Programming assignments (Laborübung) in teams of 2 (or 3) students
- Seminar-like parts
- Final (oral) examination (assignments and course material)

Course Materials (On-line)

- Information about Haskell: `http://www.haskell.org/`
- Haskell-Tutorial:
  `http://www.haskell.org/tutorial/`
- Hugs-Interpreter: `http://www.haskell.org/hugs`

Reading Material: Basics

1. Jens Knoop. Slides and companion material of the Course "Funktionale Programmierung", Institut für Computersprachen, TU Wien, 2011/2012.
2. Richard Bird. *Introduction to Functional Programming using Haskell*, Prentice-Hall, 2nd edition, 1998.
3. Simon Thompson. *Haskell: The Craft of Functional Programming*, Addison-Wesley (Pearson), 2nd edition, 1999.
4. Peter Pepper. *Funktionale Programmierung in OPAL, ML, Haskell und Gofer*, Springer-V., 2. Auflage, 2003. (In German)
5. Peter Pepper, Petra Hofstedt. *Funktionale Programmierung*, Springer-V., 1. Auflage, 2006. (In German)
6. Wolfram-Manfred Lippe. *Funktionale und Applikative Programmierung*, Springer-V., 2009. (In German)
7. ...

Reading Material: Advanced

1. Lectures on *Advanced Functional Programming*, International Summer Schools 1995, 1996, 1998, 2002; erschienen als LNCS 925, 1129, 1608, 2638, Springer-Verlag.
2. Jeremy Gibbons, Oege de Moor. *The Fun of Programming*, Palgrave Macmillan, 2003.
3. Chris Okasaki. *Purely Functional Data Structures*, Cambridge University Press, 1999.
4. Simon L. Peyton Jones. *The Implementation of Functional Programming Languages*, Prentice-Hall, 1987.
5. Andrew W. Appel. *Modern Compiler Implementation in ML*, Cambridge University Press, 1998.
6. Ravi Sethi. *Programming Languages: Concepts and Constructs*, 2nd edition, Addison-Wesley, 1995.
7. ...

Reading Material: Advanced

Hints to further readings will be provided on-the-fly during the course.

Registration, Accounts, and Passwords

In detail:

- Registration:
  - Via the electronic registration management system of AB E185.1 on or before 25 March 2012
  - For further information visit the homepage of the course: `www.complang.tuwien.ac.at/knoop/ffp185210_ss2012.html`
- Creation of account (including account name and password):
  - ...automatically in the course of registration.
- Deregistration:
  - On or before 1 April 2012; also via the electronic registration management system
- In case of questions&problems regarding the electronic registration:
  - David Flamme (`studass@complang.tuwien.ac.at`)

Lecture, Assignments, Project

- Lectures (block style): usually each Thursday from 4:15 p.m. to 5:45 p.m., lecture room on the ground floor, Argentinierstr. 8; for the first time today on 15 March 2011.
- Assignments: Usually each Tuesday; starting on 20 March 2012.
- Assignments and slides of lectures available on the homepage of the course.
- Submissions: Automatically collected and checked one week after publication at noon; must be stored in the home directory of your account.
- Second submission after fixing bugs: Another week later.
- In total ca. 7 assignments, possibly a larger project with presentation in the audience (seminar style).

Usage of Computers

- Server: `g0.complang.tuwien.ac.at`
- Terminals for course usage (Argentinierstr. 8, Lab on the ground floor of the Institutsgebäude, Argentinierstr. 8, 1040 Vienna)
- Usage of other computers is encouraged (e.g. at home)
- Required software: Hugs (available free of charge)
- Solutions of assignments must be delivered on `g0.complang.tuwien.ac.at`

Assessment

- Based on final examination and grades on assignments
- Positive grade only, if all parts are positive
- Final examination: oral
- Points (pts) for solutions: max. 100 pts/assignment, ca. 7 assignments in total
- Minimum 50% in total of the points for an positive overall grade on assignments
- half of the points for second deliveries of assignments

In case of questions and problems

- Homepage:
  www.complang.tuwien.ac.at/knoop/ffp185210_ss2012.html
- E-mail: knoop@complang.tuwien.ac.at
- Ulrich Neumerkel
  David Flamme (studass@complang.tuwien.ac.at)

A perfect Add-on

...this term:

- LVA 127.008
  Haskell-Praxis: Programmieren mit der Funktionalen Programmiersprache Haskell
  (127.008 VU 2.0h ECTS 3.0)
  Tue, 3 p.m. to 4:30 p.m.,
  Seminar room 127, 3rd floor, Gußhausenstr. 25-29

  Prof. Dr. Andreas Frank
  Institut für Geoinformation und Kartographie
  (The course will be held in English).

Interested in studying abroad?

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

- Universidade do Minho, Braga, Portugal
- Technical University of Lissabon, Portugal
- 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!

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