Test

The INFDEV team

Hogeschool Rotterdam
Rotterdam, Netherlands

Introduction

Introduction

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Course introduction

Examination

Semantics of traditional programming languages

Lecture topics

- Course introduction
- Exam and practicum
- Semantics of traditional programming languages
- Substitution rules and referential transparency
- Basic lambda calculus

Course introduction

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Course topics

- We will discuss a completely new paradigm for expressing programs
- This paradigm, functional programming, is based on different premises on computation
- It gives guarantees of correctness in complex places, like parallelism or separation of concerns
- It requires a radical conceptual shift in the way you think about programming

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Course topics

- We will begin with a short discussion on traditional programming language extbfsemantics
- We will then show the extbflambda calculus, which is the foundation for functional languages
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- We will then bridge the gap between theory and practice

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  - We will translate the lambda calculus into two mainstream functional languages: F# and Haskell
  - This will cover a huge chunk of possible applications in countless other languages and libraries, from C# LINQ to Java streams, to Scala, Scheme, Closure, etc.

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Exam structure

- There is a theoretical exam, where you show understanding of the basic principles
- There is a practical exam, where you show understanding of their concrete applications

Examination

Theoretical exam

- One question on a lambda calculus program execution
- One question on the type system of a lambda calculus program, F# program, or Haskell program
- Both questions must be answered correctly to get a extbfvoldoende

Examination

Build, in groups of max four, any of the following applications in either Haskell or F#:

- A 2D simulation of a supermarket with customers, cash registers, and various aisles
- A 2D simulation of a supply chain with trucks, containers, and ships
- An interpreter for a Python-like language (with a parser for an extra challenge)
- An interpreter for the lambda calculus (with a parser for an extra challenge)

We will get together at the end of the course, and the teacher(s) will remove a few lines from each of your applications. **Individually** you will have to restore them within a few hours.

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- Traditional, imperative programming languages are based on sharing memory through instructions
- This means that subsequent instructions are not independent from each other
- Any function call makes use of the available memory

Semantics of traditional programming languages

For example, consider the semantic rules that describe the working of “;”

$$\frac{\langle s_1, S, H\rangle \rightarrow \langle S_1, H_1\rangle \wedge \ \langle s_2, S_1, H_1\rangle \rightarrow \langle S_2, H_2\rangle}{\langle (s_1; s_2), S, H\rangle \rightarrow \langle S_2, H_2\rangle}$$

Semantics of traditional programming languages


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Semantics of traditional programming languages


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Semantics of traditional programming languages


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(((λt→f→t) T) F)
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$$\texttt{(}\underline{\texttt{((}\lambda\texttt{t}\rightarrow\texttt{f}\rightarrow\texttt{t) T)}}\texttt{ F)}$$

$$\texttt{((}\lambda\texttt{f}\rightarrow\texttt{T) F)}$$

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```
((λf→T) F)
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((λf→T) F)
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((λf→T) F)
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Semantics of traditional programming languages

$\underline{((\lambda f \to T)\ F)}$

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$\underline{\texttt{((}\lambda\texttt{f}\rightarrow\texttt{T) F)}}$

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T
```

This is it!

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The best of luck, and thanks for the attention!