Programming Paradigms Introduction (Part 1)

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About Me: Michael Pradel

- **Since 9/2019: Full Professor at University of Stuttgart**

- **Before**
  - Studies at TU Dresden, ECP (Paris), and EPFL (Lausanne)
  - PhD at ETH Zurich, Switzerland
  - Postdoctoral researcher at UC Berkeley, USA
  - Assistant Professor at TU Darmstadt
  - Sabbatical at Facebook, Menlo Park, USA

About the Software Lab

- **My research group since 2014**
- **Focus: Tools and techniques for building reliable, efficient, and secure software**
  - □ Program testing and analysis
  - □ Machine learning, security
- **Thesis and job opportunities**

Overview

- **Motivation** ←
  - ☐ What the course is about
  - ☐ Why it is interesting
  - ☐ How it can help you

- **Organization**
  - ☐ Exercises
  - ☐ Grading

- **Introduction**
  - ☐ Programming languages:
    History, paradigms, compilation, interpretation

The Role of Programming

- **Programming: Essential form of expression for a computer scientist**

  - ”The limits of my language mean the limits of my world.” (Ludwig Wittgenstein)

- **Programming languages determine what algorithms and ideas you can express**

Goal of this Course

Understand how programming languages (PLs) work

- How are languages defined?

- What language design choices exist?

- How are languages implemented?

Why Learn About PLs?

Enables you to

- choose right PL for a specific purpose

- choose among alternative ways to express things

- make best use of tools (e.g., debuggers, IDEs, analysis tools)

- understand obscure language features

- simulate useful features in languages that lack them

Concepts vs. Languages

This course **is not about**

- All details of a specific language

- A systematic walk through a set of languages

Instead, this course **is about**

- Concepts underlying many languages

- Various languages as examples

Isn't Knowing {Pick a PL} Enough?

- **Complex systems: Built in various languages**

    - □ E.g., Facebook: Wild mix of languages covering various language paradigms

- **New languages arrive regularly (and old ones fade away)**

Isn't Knowing {Pick a PL} Enough?

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