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  Principles of **Programming Languages**

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  I hope most of you will achieve this.

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- Highest: “I began to see through the features in programming languages.”

  Deconstruction/Reductionism of Programming Languages?

  This one is very hard. I’m not sure I can teach it either.

Course Overview

Part I:

- Haskell (functional), Curry (logic).
  Not comprehensive—I show the hard parts, you pick up the easy parts, and we focus on the parts we need.
- Basic topics.

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Part II:

- Syntax: Moar context-free grammars; simple parsers.
- Semantics: By toy language models in Haskell.
  Why Haskell: Almost like math definition, and executable.
  (In a grad course I would use actual pure math.)
- Advanced topics.

Next few slides elaborate a bit. . .

Example Topic: Evaluation Order

Define $f(x) = 4$. Now $f(1/0) = ?$

Call by value (most languages): Evaluate $1/0$ first. Error.

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Aside: Scheme is call by value, but provides a macro system for user-definable control constructs and other constructs.

Example Topic: Parametric Polymorphism

In Haskell define: `trio x = [x, x, x]`
[Inferred] Type: `t -> [t]`
Like Java's `<t> LinkedList<t> trio(<t> x)`

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User chooses what type to use for the type variable `t`, *and* implementation not told what it is.

Consequence: Uniform behaviour. Can't vary by types:

```
trio 0 = [0, 0, 0]
trio "hello" = []
```

Less flexible, but easier to test—test on one type and conclude for all types.

If we have time, I'll show you how to *prove* that.

Some Other Example Topics

Type inference.

Model of local variables and local functions.

If there is time: Model of mutable variables.

If there is time: Continuations.

Practicality

My presentation of languages will tend to be academic.

This is not because they are impractical. It is only because I am teaching selected topics.

Example: I use naïve singly-linked lists all the time, but data structures for grown-ups such as random-access arrays and efficient dictionaries are available.