

Comp 411
Principles of Programming Languages
Lecture 10
The Semantics of Recursion

Corky Cartwright
Swarat Chaudhuri
September 14, 2011

Key Intuitions

- Computation is incremental not monolithic
- Slogan: general computation is successive approximation (typically in response to successive demand for more information).

Key Mathematical Concepts

Domains:

- (weak) partial order
- chain
- chain-complete
- complete partial order (**cpo**)
- “home-plate” **cpo**
- consistently-complete
- bottom (\perp)
- flat domains

Key Mathematical Concepts

Computable functions:

- monotonic (universal)
- continuous (universal)
- strict (typical)

Examples

Domains

- flat domains
- strict function spaces on flat domains
- lazy trees of boolean (of D where D is flat)
- factorial functional

A Bigger Challenge

Assume that we want to write LC in a purely functional language without a recursive binding construct (say functional Scheme without **define** and **letrec**)?

- Key problem: must expand **letrec** into **lambda**
- No simple solution to this problem. We need to invoke syntactic magic or develop some sophisticated mathematical machinery.