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

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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 \((\text{cpo})\)
• “home-plate” \(\text{cpo}\)
• consistently-complete
• bottom \((\bot)\)
• 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.