Comp 311
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 (cpo)
• “home-plate” cpo
• consistently-complete
• bot ($\bot$)
• flat domains
Key Mathematical Concepts

Computable functions:

- monotonic
- continuous
- strict
- flat domain
- “home-plate” cpo
- consistently-complete
- bot (⊥)
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 \texttt{define} and \texttt{letrec})?

• Key problem: must expand \texttt{letrec} into \texttt{lambda}

• No simple solution to this problem. We need to invoke syntactic magic or develop some sophisticated mathematical machinery.