

CSE216

Programming Abstraction

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Agenda

- Practice on lambda calculus syntax and semantics

Lambda calculus syntax summary

- $\text{TERM} ::= \text{Var}$ // Variables
- | lambda Var. TERM // Definition/Abstraction
- | TERM TERM // Application

$\text{Var} ::= x \mid y \mid z \dots$

Lambda calculus semantics summary

- $(\lambda x.M)N \rightarrow M$ with bound occurrences of x substituted by N
- Sometimes written $M [x \rightarrow N]$
- Something to say later, called “capture-avoiding”

Draw parse trees

- $\lambda x. x \lambda y$

Draw parse trees

- $\lambda x. \lambda y. x y \lambda z. z y$

Draw parse trees

- $\lambda x. \lambda y. x y z$

beta-reduction

- $(\lambda x.xx)(\lambda y.yx)z$

beta-reduction

- $(\lambda x.xx)(\lambda y.yx)z$

beta-reduction

- Someone thinks the lambda expression $((\lambda x. \lambda y. y) y) (\lambda x. x a)$ reduces to a . Can you spot the issue?