Lambda Calculus Week4

Michelle Bergin

November 1, 2018

1 Sel2013 Exercises 5-7

5 Find λ terms **or** and **not** that encode the boolean functions "or" and "not". Can you find more than one term?
Or: $\lambda ab.aTb$
Not: I haven't been able to figure it out...

6 (a) Manually evaluate the λ terms **add**$\overline{23}$ and **mult**$\overline{23}$

- **add**$\overline{23}$
  $\lambda mnfx.mf(nfx)(\overline{2})(\overline{3})$
  $\lambda nfx.(\overline{2})f(nfx)(\overline{3})$
  $\lambda fx.(\overline{2})f(\overline{3}fx)$
  $\lambda fx.(\lambda fx.f(fx))f((\lambda fx.f(f(fx)))fx)$
  $\lambda fx.(\lambda fx.f(fx))f(f(f(fx)))$
  $\lambda fx.f(f(f(f(fx))))$
- **mult** $\overline{23}$
  $\lambda nmf.n(mf)(\overline{2})(\overline{3})$
  $\lambda mf.(\overline{2})(mf)(\overline{3})$
  $\lambda f.(\overline{2})(\overline{3}f)$
  $\lambda f.(\overline{2})((\lambda fx.f(f(fx)))f)$
  $\lambda f.(\lambda fx.(f(fx))(ffff)$
  $\lambda f.(ffffff)$
  Is this even right... There is no x...

7 Find λ terms that represent each of the following functions:

(a) $f(n) = (n+3)^2$
$(\lambda fnm.n(mf)(\overline{n})(\overline{3}))(\lambda fnm.n(mf)(\overline{n})(\overline{3}))$

(b) $f(n) = \begin{cases} \text{true} & \text{if } n \text{ is even,} \\ \text{false} & \text{if } n \text{ is odd,} \end{cases}$

(c)