

Functional Programming WS 2018/2019 LVA 703024+703025

Exercises 6 December 7, 2018

All Solutions

3 Applicative Order

$$(\lambda w. w) ((\underline{\lambda x y. y}) (z z))$$

$$\rightarrow_{\beta} (\lambda w. w) (\lambda y. y)$$

$$\rightarrow_{\beta} \lambda y. y$$

Applicative Order

$$\frac{(\lambda xy. x) (\lambda z. y z)}{\rightarrow_{\beta} \lambda y'. \lambda z. y z}$$

Applicative Order

$$\lambda z. \underbrace{(\lambda x. x \ z \ y) \ (\lambda xy. y \ z)}_{\beta \lambda z. \underbrace{(\lambda xy. y \ z) \ z}_{y} y}$$

$$\rightarrow_{\beta} \lambda z. \underbrace{(\lambda y. y \ z) \ y}_{\beta \lambda z. \underbrace{(\lambda y. y \ z) \ y}_{z}}$$

$$\rightarrow_{\beta} \lambda z. y \ z$$

Applicative Order

$$\begin{aligned} &\lambda xy.\,y\,\left(\lambda w.\,w\right)\,\left(\lambda yz.\,y\,\,x\right)\\ &=\lambda xy.\left(y\,\left(\lambda w.\,w\right)\right)\,\left(\lambda yz.\,y\,\,x\right) \end{aligned}$$

Normal Order

$$\frac{(\lambda w. w) ((\lambda xy. y) (z z))}{\rightarrow_{\beta} (\lambda xy. y) (z z)}$$
$$\rightarrow_{\beta} \lambda y. y$$

Normal Order

$$\frac{(\lambda xy. x) (\lambda z. y z)}{\rightarrow_{\beta} \lambda y'. \lambda z. y z}$$

Normal Order

$$\begin{array}{l} \lambda z. \, \underline{(\lambda x. \, x \, z \, y) \, (\lambda xy. \, y \, z)} \\ \rightarrow_{\beta} \lambda z. \, \underline{(\lambda xy. \, y \, z) \, z} \, y \\ \rightarrow_{\beta} \lambda z. \, \underline{(\lambda y. \, y \, z) \, y} \\ \rightarrow_{\beta} \lambda z. \, \underline{y} \, z \end{array}$$

Normal Order

$$\begin{split} &\lambda xy.\,y\,\left(\lambda w.\,w\right)\,\left(\lambda yz.\,y\,\,x\right)\\ &=\lambda xy.\left(y\,\left(\lambda w.\,w\right)\right)\,\left(\lambda yz.\,y\,\,x\right) \end{split}$$