HW1 Lambda Calculus - Graded

Score: 49 / 60

- *-3 points*: No labels above reductions.

Problem 3

$(\lambda x.\, y)x = y$

Problem 3. $(\lambda x.\, x\ y)(\lambda y.\, y\ z)$

$$(\lambda x.\, x\ y)(\lambda y.\, y\ z) = (\lambda x.\, x\ y)(\lambda a.\, a\ z) = (\lambda a.\, a\ z)y = y\ z$$

Problem 4. $(\lambda x.\, x\ y)(\lambda a.\, a\ b)n$

- Unnecessary α-conversion

-2 points

Problem 8

$(\lambda x.\, y\ x)y = y\ y$

Problem 8 $(\lambda x.\, \lambda y.\, x\ y\ z)(\lambda x.\, x\ y)z$

$$(\lambda x.\, \lambda y.\, x\ y\ z)(\lambda x.\, x\ y)z = (\lambda x.\, \lambda a.\, x\ a\ z)(\lambda x.\, x\ y)z = (\lambda x.\, x\ y)\ z\ z = z\ y\ z$$

Problem 9 $(\lambda x.\, x\ x)x$

- Two β-reductions in one step

-2 points

Problem 9

Problem 9 $(\lambda x.\, y\ x)x$

$$(\lambda x.\, y\ x)x = (\lambda z.\, y\ z)x = y\ x$$

Problem 10 $(\lambda x.\, x\ x)(\lambda z.\, z\ x)$

- Unnecessary α-conversion

-2 points

Problem 10

Problem 10 $(\lambda y.\, y\ x)(\lambda z.\, z\ y)$

$$(\lambda y.\, y\ x)(\lambda z.\, z\ y) = (\lambda a.\, a\ x)(\lambda z.\, z\ y) = (\lambda z.\, z\ y)\ x = x\ y$$

- Unnecessary α-conversion

-2 points

Original

HW1 – Lambda Calculus

Problem 1. $(\lambda x.\, x)y$

$$(\lambda x.\, x)y = y$$

Problem 2. $(\lambda x.\, y)x$

$$(\lambda x.\, y)x = y$$

Problem 3. $(\lambda x.\, x\ y)(\lambda y.\, y\ z)$

$$(\lambda x.\, x\ y)(\lambda y.\, y\ z) = (\lambda x.\, x\ y)(\lambda a.\, a\ z) = (\lambda a.\, a\ z)y = y\ z$$

Problem 4. $(\lambda x.\, x\ y)(\lambda a.\, a\ b)p$

$$(\lambda x.\, x\ y)(\lambda a.\, a\ b)p = (\lambda a.\, a\ b)\ y\ p = y\ b\ p$$

Problem 5 $(\lambda x.\, x\ y)(\lambda a.\, b\ a)p$

$$(\lambda x.\, x\ y)(\lambda a.\, b\ a)p = (\lambda a.\, b\ a)y\ p = b\ y\ p$$

Problem 6 $(\lambda x.\, (\lambda y.\, x\ y))\ y$

$$\big(\lambda x.\, (\lambda y.\, x\ y)\big)y = \big(\lambda x.\, (\lambda z.\, x\ z)\big)y = \lambda z.\, y\ z$$

Problem 7 $(\lambda x.\, y\ x)y$

$$(\lambda x.\, y\ x)y = y\ y$$

Problem 8 $(\lambda x.\, \lambda y.\, x\ y\ z)(\lambda x.\, x\ y)z$

$$(\lambda x.\, \lambda y.\, x\ y\ z)(\lambda x.\, x\ y)z = (\lambda x.\, \lambda a.\, x\ a\ z)(\lambda x.\, x\ y)z = (\lambda x.\, x\ y)\ z\ z = z\ y\ z$$

Problem 9 $(\lambda x.\, y\ x)x$

$$(\lambda x.\, y\ x)x = (\lambda z.\, y\ z)x = y\ x$$

Problem 10 $(\lambda y.\, y\ x)(\lambda z.\, z\ y)$

$$(\lambda y.\, y\ x)(\lambda z.\, z\ y) = (\lambda a.\, a\ x)(\lambda z.\, z\ y) = (\lambda z.\, z\ y)\ x = x\ y$$