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COMP 3007 – Assignment 1 (Q2: “Beta Reduction”)

QUESTION A

$\lambda a. (\lambda b. (\lambda c. (b ((a\ b)\ c)))) (\lambda d. (\lambda e. (d\ (d\ (d\ e)))))$

$\lambda b. (\lambda c. (b (((\lambda d. (\lambda e. (d\ (d\ (d\ e))))\ b)\ c)))$

$\lambda b. (\lambda c. (b ((\lambda e. (b\ (b\ (b\ e))))\ c)))$

$\lambda b. (\lambda c. (b\ (b\ (b\ (b\ c)))))$

(n.b., α -Equivalent to the church numeral “four”.)

QUESTION B

$\lambda a. (\lambda b. (\lambda f. (\lambda x. ((a\ f)((b\ f)\ x)))) (\lambda f. (\lambda x. (f\ x)))(\lambda f. (\lambda x. x))$

$\lambda b. (\lambda f. (\lambda x. (((\lambda f. (\lambda x. x))\ f)((b\ f)\ x)))) (\lambda f. (\lambda x. (f\ x)))$

$\lambda f. (\lambda x. (((\lambda f. (\lambda x. x))\ f)((\lambda f. (\lambda x. (f\ x)))\ f)\ x)))$

$\lambda f. (\lambda x. ((\lambda x. x)((\lambda f. (\lambda x. (f\ x)))\ f)\ x)))$

$\lambda f. (\lambda x. ((\lambda x. x)((\lambda x. (f\ x))\ x)))$

$\lambda f. (\lambda x. ((\lambda x. x)(f\ x)))$

$\lambda f. (\lambda x. (f\ x))$

(n.b., α -Equivalent to the church numeral “one”.)