

Assignment0220

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$$\begin{aligned} 1. & (\lambda n. f (f (f n))) (\lambda x. f (x + 1)) (\lambda x. x) 0 \\ &= (\lambda n. (\lambda z. (\lambda y. (\lambda x. n (x + 1)) (y + 1)) (z + 1))) (\lambda x. x) 0 \\ &= (\lambda n. (\lambda z. n (z + 3))) (\lambda x. x) 0 \\ &= (\lambda z. (z + 3)) 0 \\ &= 3. \end{aligned}$$

$$\begin{aligned} 2. & (\lambda n. f (f (f n))) (\lambda x. f (x + 1)) (\lambda x. x - 2) 0 \\ &= (\lambda n. (\lambda z. n (z + 3))) (\lambda x. x - 2) 0 \\ &= (\lambda z. (z + 3) - 2) 0 \\ &= 1. \end{aligned}$$

$$\begin{aligned} 3. & (\lambda n. f (f (f n))) (\lambda x. f (x + 1)) (\lambda x. x * x) 0 \\ &= (\lambda n. (\lambda z. n (z + 3))) (\lambda x. x * x) 0 \\ &= (\lambda z. (z + 3) * (z + 3)) 0 \\ &= 9. \end{aligned}$$

$$\begin{aligned} 4. & (\lambda f g x. f (g x)) (\lambda x. x - 2) (\lambda x. x * x) 10 \\ &= (\lambda g x. (g x) - 2) (\lambda x. x * x) 10 \\ &= (\lambda x. x * x - 2) 10 \\ &= 98. \end{aligned}$$

$$\begin{aligned} 5. & (\lambda f g x. f (g x)) (\lambda x. x * x) (\lambda x. x - 2) 10 \\ &= (\lambda g x. (g x) * (g x)) (\lambda x. x - 2) 10 \\ &= (\lambda x. (x - 2) * (x - 2)) 10 \\ &= 64. \end{aligned}$$

$$\begin{aligned} 6. & (\lambda f n. f (f (f n))) (\lambda f x y. f y x) = \lambda f x y. f y x. \\ & (\lambda f x y. f y x) (\lambda f g x. f (g x)) = \lambda f g x. g (f x). \\ & (\lambda f g x. g (f x)) (\lambda x. x * x) = \lambda g x. g (x * x). \\ & (\lambda g x. g (x * x)) (\lambda x. x - 2) = \lambda x. (x * x) - 2. \\ & (\lambda x. (x * x) - 2) 10 = 98. \end{aligned}$$