

## CS 4110 – Programming Languages and Logics Proof Writing Workshop Problem



**Due** Tuesday, October 18th, 2016 at 7:00 PM.

**Instructions** Please complete this assignment on your own. Bring a completed solution to the workshop, along with some writing instruments and scratch paper.

**Exercise 1.** Let  $x$  and  $y$  be variables, and  $e_1$ ,  $e_2$ , and  $e$  be expressions in  $\lambda$ -calculus. Prove that if  $x \neq y$ ,  $x \notin fvs(e_2)$ , and  $y \notin fvs(e_1)$ , then  $e[e_1/x][e_2/y] = e[e_2/y][e_1/x]$ . Prove also that the converse does not hold.

### Debriefing

- (a) How many hours did you spend on this assignment?
- (b) Would you rate it as easy, moderate, or difficult?
- (c) How deeply do you feel you understand the material it covers (0%–100%)?
- (d) If you have any other comments, we would like to hear them! Please write them here or send email to [asampson@cs.cornell.edu](mailto:asampson@cs.cornell.edu).