
HW 11 – Lambda Calculus

CS 421 – Spring 2014

Revision 1.0

Assigned Thursday, April 17, 2014

Due Sunday, May 4, 2014, 11:59 pm

1 Change Log

1.0 Initial Release.

2 Turn-In Procedure

This assignment is named `hw11`. Using your favorite tool(s), you should put your solution in a file named `hw11-solution.pdf`. Your answers to the following questions are to be submitted using the svn repository as described in the section **Instruction for Solving and Submitting Assignments on the web-page**: <http://courses.engr.illinois.edu/cs421/sp2014/mps/index.html>

3 Objectives and Background

The purpose of this HW is to test your understanding of:

- Alpha and beta conversion in the lambda calculus
- The consequences of different evaluation schemes
- experience answering non-programming written questions similar to those on the final

4 Problems

1. (15 pts) Prove that $(\lambda y.xy)(\lambda x.\lambda y.yx)$ is α -equivalent $(\lambda z.xz)(\lambda y.\lambda x.xy)$

You should label every use of α -conversion and congruence.

2. (15 pts) Given the following term:

$$(\lambda x.x(\lambda y.xy))((\lambda u.u)(\lambda w.w))$$

reduce this term as much as possible using each of

- a. eager evaluation
- b. lazy evaluation
- c. unrestricted $\alpha\beta$ -reduction (*i.e.* by $\alpha\beta$ conversion that can be applied anywhere)

Label each step of reduction with the rule justifying it. You do not need to label uses of congruence, or break them out as separate steps, in this problem.