

Programming Languages (COP 4020/6021) [Spring 2019]

Assignment V

Objectives

1. To understand several programming-language properties used to prove type safety, including Weakening, Substitution, Inversion, and Canonical Forms.
2. To understand type safety at a technical level by proving it for a small language.

Due Date: Monday, April 8, 2019 (at 5pm).

Assignment Description

Do the following by yourself.

Recall the following language L from previous assignments:

types $\tau ::= \text{bool} \mid \tau_1 \times \tau_2$

exprs $e ::= x \mid \text{true} \mid \text{false} \mid e_1 \text{ NOR } e_2 \mid (e_1, e_2) \mid \text{let val } (x_1, x_2) = e_1 \text{ in } e_2 \text{ end}$

Using the definitions discussed in class (of L's free variables, alpha-conversion, substitution, and static and dynamic semantics), prove that L is type safe. You'll need to state and prove Weakening, Substitution, Inversion, and Canonical Forms Lemmas, Progress and Preservation Theorems, and finally the Type Safety Theorem/Corollary.

Hints

This assignment may require several hours of writing, but you have all the tools needed to complete it.

As always, you may assume that expressions are implicitly alpha-converted to avoid contexts having more than one entry for the same variable.

Submission Notes

- Write the following pledge at the end of your submission: "I pledge my Honor that I have not cheated, and will not cheat, on this assignment." Sign your name after the pledge. Not including this pledge will lower your grade 50%.
- For full credit, turn in a hardcopy (handwritten or printed) version of your solutions.
- You may submit this assignment late (i.e., between 5pm on 4/8 and 5pm on 4/10) with a 15% penalty on the whole assignment.
- Late submissions may be emailed or submitted in hardcopy.
- All emailed submissions, even if sent before the deadline, will be graded as if they were submitted late, i.e., with a 15% penalty.
- If you think there's a chance you'll be absent or late for class on the date this assignment is due, you're welcome to submit solutions early by giving them to me or the TA before or after class, or during any of our office hours.