CS 578 PL Semantics Homework 2 – due 4:40pm, Tuesday, Apr. 16, 2024

You should do all problems, but only those marked with an asterisk (*) must be submitted. (You may submit the others for feedback if you wish.)

Solutions may be submitted on paper at start of class, or by email before class.

Preparing your submission using latex is strongly suggested, but if your handwriting is sufficiently legible, hand-written submissions are also acceptable.

Email solutions should be sent to `tolmach@pdx.edu`, with the subject line "CS578 HW2" and one `.pdf` file and a `core.ml` file as simple attachments. (If your solution is handwritten, you must scan or photograph it, and produce `.pdf` for submission.)

All programs mentioned can be downloaded via the course web page; the relevant code for this assignment is in the `untyped` directory.

1. Reformulate the small-step semantic rules for the pure λ-calculus in Figure 5-3 as a contextual semantics.

2. Do Pierce 5.2.2.

3. Do Pierce 5.2.4.

* 4. Do Pierce 5.2.8. (Check the book's errata page!)

* 5. Do Pierce 5.3.6 for full beta-reduction and for "lazy" (which here is intended to mean call-by-name) evaluation. (Note: the book's solution for full beta-reduction is missing a rule – even though there is no erratum on the list.)

6. Do Pierce 5.3.8. ("Exercise 4.2.2" should be "Exercise 3.5.17" and there is an erratum in the book's solution.) In addition to giving the rules, it is good practice to prove that big-step and small-step semantics coincide for terminating computations, i.e. $t \rightarrow^* v$ iff $t \Downarrow v$.

7. Do Pierce 6.1.1.

8. Do Pierce 6.2.2.

* 9. Do Pierce 7.3.1. Once again, just change the implementation of the `eval` function in `core.ml`. If no big-step rule applies, raise the `NoRuleApplies` exception; unlike in the small-step case, this should *not* be caught, but should instead propagate to the top level. (Note that variables are *not* values.) Submit just your changed `core.ml` file.