CSE 3302 Programming Language

Homework 4 - Spring 2026

Due Date: Feb. 16, 2026, 11:59 PM

Problem 1 - 30%

Prove the **exchange lemma**: If $\Gamma, x : t_1, y : t_2, \Gamma' \vdash e : t$, then $\Gamma, y : t_2, x : t_1, \Gamma' \vdash e : t$. (proof by induction on derivation of $\Gamma, x : t_1, y : t_2, \Gamma' \vdash e : t$).

Problem 2 - 35%

Prove the **weakening lemma**: If $\Gamma \vdash e : t$ then $\Gamma, x : t' \vdash e : t$ (provided x not in Dom(Γ)).

Problem 3 - 35%

Prove the **substitution lemma**: If $\Gamma, x : t' \vdash e : t$ and $\Gamma \vdash v : t'$ then $\Gamma \vdash e[v/x] : t$.

Submission Format: Submit only the `.pdf` version of your homework (typed submissions are preferred; Scanned images must be readable). File must be named `lastname_studentID_hw4.pdf`.