

# CMPT 383 Comparative Programming Languages

## Homework 7

This homework is due by 11:59pm PT on Tuesday Apr 1, 2025. No late submission is accepted. Please save your answers in a single file called `H7_SFUID.pdf` and submit it to Canvas. You may also write on paper and scan it (or take a picture) into a PDF. Please make sure the text is readable.

1. (20 points) Consider the FUN language with type annotations, prove the type of following expression is  $Int \rightarrow Int$ . In other words, show the derivation process using the type checking rules (with prefix T-).

`lambda x : Int. 2 + x`

2. (30 points) Consider the FUN language with type annotations, prove the type of following expression is  $Int$  using the type checking rules (with prefix T-).

`let f : Int->Int = lambda x : Int. x in app f 1`

3. (10 points) Find a most general unifier of the following constraints. You do not need to show the steps.

$\{X_1 = X_2 \rightarrow X_3, X_2 = X_3 \rightarrow X_4, X_3 = Int\}$

4. (30 points) Consider the FUN language without type annotations, perform constraint-based type checking of the following expression using rules with CT- prefix (use CT-Ident1 and CT-Ident2 instead of CT-Ident). You need to show the derivation steps.

`let f = lambda x. x in app f 1`

5. (10 points) Consider Question 4 again, find a most general unifier of the final constraints. You do not need to show the steps.