

CS558 Programming Languages – Fall 2023 – Study Questions Lecture 7b

These questions are intended for self-study, to help review and deepen your understanding of the lecture. Sample answers are available. There is nothing to hand in.

1. For each of the following expression, draw an abstract syntax tree and number the nodes. Then, using the method shown in lecture, write down the typing constraints implied by each node. Solve the constraints (using unification as detailed in the handout, or just by inspection) to determine the types of each identifier used in the expression, and the type of the entire expression (the root of the tree).

(a) A simple monomorphic expression:

```
(let f
  (fun x
    x)
  (fun y
    (fun z
      (if y
        z
        (@ f 3))))))
```

(b) The polymorphic compose function:

```
(fun f
  (fun g
    (fun x (@ f (@ g x))))))
```