CS103 Programming Languages: Homework 1

Due Date: 1/31/06 by 11:55PM

Submission: Hardcopy submissions of this assignment should be given to Prof. Skalka, either directly or placed in the Votey 379 drop box (on the wall next to the door). Electronic submissions should be handed in using the submit program.

Problem 1 (20 points). In each of the following expressions, identify each declared variable, along with its scope. You may use informal diagrams, as long as they’re clear.

a. let x : int = 3 in let y : int = 4 in x * y
b. let x : int = 2 in 3 + (let y : int = x - 7 in y * x)
c. let x : int = 1 in let z : int = 2 + x in x + z

Problem 2 (40 points). For each of the following expressions e, decide whether a type can be assigned to e. If you think e is typable, specify τ such that e : τ, and also specify v such that e ⇓ v; otherwise, briefly explain why e cannot be typed.

a. true
b. 5 - 3
c. 3 + 2.1
d. false || 0
e. if 2 < 4 then 1 else false
f. if 3 = (1 + 2) then "true" else "not true"
g. let x : bool = true in (not x)
h. ("a" ^ "c") < "abz"

Problem 3 (40 points). Consider the following sequences of declarations and expressions, assumed entered at the top-level loop of the OCaml interpreter:

a. let x : int = 1;;
   let y : bool = true;;

b. let x : int = 3;;
   let y : bool = false;;
   let y : bool = true in not y;;

c. let x : int = 5;;
   let y : bool = (x <> 0);;
   let x : int = 1;;

d. let x : int = 2;;
   let y : bool = (x = 3);;
   let x : int = 6 in x * 2;;

For each sequence, specify v such that ((x = 5) = y) ↓ v immediately after the entire sequence has been entered (i.e. assume no intervening declarations). Also, briefly explain (in english) why the expression evaluates as it does, by specifying the value bindings that are in effect during evaluation. For example, immediately after sequence (a) has been entered, ((x = 5) = y) ↓ false, since the bindings of x to 1 and y to true are in effect during evaluation of the expression.