

Com S 342 HW 3.

1. (4 pt) Write Varlang programs:

(a) (1 pt) Compute the temperature in Celsius given a temperature $f = 58$ in Fahrenheit

`(let ((f 58)) (* (/ 5 9) (- f 32)))`

\$ 14.444444444445

(b) (3 pt) Write a VarLang program that evaluates to value 0. The program must include at least 2 let expressions and there must be a “hole in one of the scopes.” (The definition of this kind is seen in section 3.3 of Rajan-PL book pg 48),

For example: `(let ((x 2) (y 4)) (let ((x 5) (z 10)) (let ((z 20)) (- (* x y) z))))`

\$ 0

`(let ((x 1)(y x)) (let ((x 2)(y x)) (- (let ((w 1)(y 1)) (+ w y)) 2)))`

\$ 0

2. (4 pt) Compute the values of the following Varlang expressions. (Return an error if the values cannot be computed.) Please list the steps to show that you understand the scoping rules and semantics of the VarLang program.

(a) `(+ (let ((y 1)) y) (let ((z 2) (x y)) (+ x z)))`

The scope of y 's definition in this program is the body, y . Thus, $y = 1$ becomes the first operand of the $+$ operation.

The scope of z 's definition in this program is the entire body of the second let expression which is $z = 2$.

The scope of x 's definition in this program is also the entire body of the second let expression. However, y is not defined in this expression so that it occurs an error.

Result: No binding found for name: y

(b) `(let ((x 3) (y 0)) (let ((y x)) y))`

The scope of x 's and y 's definition in this program is the body, `(let ((y x)) y)`. Thus, $x = 3$ and $y = 3$. Then, the scope of y 's in the second let expression is this program is the body, y . Therefore, $y = 3$.

Result: 3.

3. (4 pt) List free and bound variables for the following Varlang expressions:

(a) (let ((c 5) (z a)) (+ c (let ((x c) (y b)) (- z (+ x y)))))

Variables: c, z, a, x, y, and b.

Bound: c, and x.

Free: z, a, y, and b.

(b) (let ((a b)) (let ((x y) (y 10)) (+ c y x (- g a))))

Variables: a, b, x, y, c, and g.

Bound: y.

Free: a, b, x, y, and c.