

COMPUTER SCIENCE MENTORS 61A

March 14 to March 19, 2016

1 What Would Scheme Print?

1. What will Scheme output? Draw box-and-pointer diagrams to help determine this.

(a) `(cons (cons 1 nil) (cons 2 (cons (cons 3 (cons 4 5)) (cons 6 nil))))`

(b) `(define a 4)`
`((lambda (x y) (+ a)) 1 2)`

(c) `((lambda (x y z) (y x)) 2 / 2)`

(d) `((lambda (x) (x x)) (lambda (y) 4))`

(e) `(define boom1 (/ 1 0))`

(f) `boom1`

(g) `(define boom2 (lambda () (/ 1 0)))`

(h) `(boom2)`

(i) Why/How are the two “boom” definitions above different?

(j) How can we rewrite boom2 without using the lambda operator?

2. What will Scheme output?

(a) `(if (/ 1 0) 1 0)`

(b) `(if 1 1 (/ 1 0))`

(c) `(if 0 (/ 1 0) 1)`

(d) `(and 1 #f (/ 1 0))`

(e) `(and 1 2 3)`

(f) `(or #f #f 0 #f (/ 1 0))`

(g) `(or #f #f (/ 1 0) 3 4)`

(h) `(and (and) (or))`

(i) Given the lines above, what can we say about interpreting `if` expressions and booleans in Scheme?

3. The following line of code does not work. Why? Write the lambda equivalent of the `let` expressions.

```
(let ((foo 3)
      (bar (+ foo 2)))
      (+ foo bar))
```

2 Scoping

4. What is the difference between dynamic and lexical scoping?
5. What would this print using lexical scoping? What would it print using dynamic scoping?

```
a = 2
def foo():
    a = 10
    return lambda x: x + a
bar = foo()
bar(10)
```

6. How would you modify an environment diagram to represent dynamic scoping?

7. Implement `waldo`. `waldo` returns `#t` if the symbol `waldo` is in a list. You may assume that the list passed in is well-formed.

```
scm> (waldo '(1 4 waldo))
#t
scm> (waldo '())
#f
scm> (waldo '(1 4 9))
#f
```

Extra challenge: Define `waldo` so that it returns the index of the list where the symbol `waldo` was found (if `waldo` is not in the list, return `#f`).

```
scm> (waldo '(1 4 waldo))
2
scm> (waldo '())
#f
scm> (waldo '(1 4 9))
#f
```