

## THIRD QUIZ

You have 15 minutes from the start of class to complete this quiz. Read the problems with care; work with deliberate speed. Don't give us more than we ask for. The usual instructions apply. Good luck!

You may show lists in any of three ways: `(cons 'AC (cons 'DC empty))`, `(list 'AC 'DC)`, or `'(AC DC)`.

### Problem 1 (5 points)

Evaluate each of the following expressions. Use this definition independently for each of the five parts:

```
(define L (cons 'beet (cons 'turnip (cons 'carrot (cons 'radish empty)))))
```

(a) `(first L)`

(b) `(rest L)`

(c) `(first (rest L))`

(d) `(rest (rest (rest L)))`

(e) `(cond`  
    `((empty? L) 'rutabaga)`  
    `((equal? 'carrot (rest (rest L))) 'daikon)`  
    `(else 'gobo))`

### Problem 2 (2 points)

What are the two main advantages of the functional programming approach over conventional imperative programming, as described in class? (You can answer this with just a few words, if they're the right words; in no case should you take more space than is available here.)

### Problem 3 (13 points)

We define a song as a structure

```
(define-struct song (title artist year length))
```

where `title` and `artist` are strings and `year` and `length` are numbers (representing the year the song was recorded and the length in seconds of the recording).

(a) (2 points) Write an expression that will create the 215-second-long song "America," recorded in 1968 by "Simon & Garfunkel." (Note that we're not asking you to define a function here.)

(b) (3 points) Fill in the blanks in the function described below. (Hint: Each vertical column contains the same thing on every line.)

```
;; song-decade: song -> symbol
;; Return a symbol indicating the decade in which the song was recorded.
(define song-decade
  (lambda ( S )
    (cond
      ((_____ (_____ _____) 1950) 'ancient) ; songs before 1950

      ((_____ (_____ _____) 1960) 'fifties)

      ((_____ (_____ _____) 1970) 'sixties)

      ((_____ (_____ _____) 1980) 'seventies)

      ((_____ (_____ _____) 1990) 'eighties)

      ((_____ (_____ _____) 2000) 'nineties)
      (else 'modern)))) ; songs after 1999
```

(c) (8 points) Define the function `song-longer?` that takes two songs as inputs and returns true if the first song is longer (in seconds) than the second song (and false otherwise).

Write a contract, a brief purpose statement, and the Scheme function definition. You do not have to write examples or tests.

#### Problem 4 (2 points)

In class we discussed circuit-switched networks and packet-switched networks.

(a) One describes message routing on the internet; the other describes conventional telephone service. Which is which?

(b) A transmission typically gets split up into pieces that may take different routes to the destination. Does this describe circuit-switching or packet-switching?